

OBSERVATIONS ON SOME AUSTRALIAN FOREST INSECTS

24. RESULTS FROM A STUDY OF THE GENUS *GLYCASPIS* (HOMOPTERA: PSYLLIDAE)

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(Figures 1-9, maps 1-5, tables 1-3).

SUMMARY

As a sequence to the taxonomic Revision of the genus *Glycaspis*, results obtained from the Australia-wide survey are presented.

Information concerning lerp, the surplus excretion of *Glycaspis* nymphs, is reviewed.

Seasonal variation in coloration of species in this genus is recorded for the first time.

Known distribution, and host plants, of species in the three subgenera are given, together with an interpretation of their possible phylogeny.

The classification of some *Eucalyptus* spp. as presented by Blakely is now apparently unsatisfactory, as workers in many disciplines have contributed new information. The significance of the *Glycaspis* spp. host associations, of possible value in a re-examination of *Eucalyptus* spp., is discussed.

Entomological studies presenting evidence for the theory of continental drift, as it concerns Australia, are briefly discussed.

INTRODUCTION

An Australia-wide study of the genus *Glycaspis* was made during the period April, 1966, to March, 1967, and the route followed during this project is shown in Map 1.

The extent and constancy of the host associations of the various species were investigated, and information of possible value to a reappraisal of the classification of the genus *Eucalyptus* was sought.

The distribution of some of the more widespread species of *Glycaspis* is given in Maps 2 to 5.

The *Glycaspis* (*Glycaspis*) spp./Hosts/Distribution, in the sequence of the insect taxonomy, are given in Table 1; *Glycaspis* spp., and their host spp., are listed alphabetically in Tables 2 and 3 respectively.

Glycaspis spp. are now known to occur in each Australian State (including Kangaroo Id. and Tasmania), New Guinea, Penang Id., Borneo, and the Philippine Islands of Palawan and Balabac. A link between the Australian psyllid fauna and that of a different biogeographical region is thus now apparent, whereas Heslop-Harrison (1949) suggested that no such evidence was available at that time.

All species of the two more primitive *Glycaspis* subgenera occur on *Eucalyptus* spp., although certain eucalypt species are not utilised as hosts; and species of the most recent subgenus occur on *Tristania* and *Melaleuca* spp.

In Australia, some species have adapted to arid environments where rainfall may be less than 8 inches per annum, and other species to moist environments where rainfall may exceed 120 inches p.a. They occur from sea-level to above 4000' altitude, and in areas where the lower or higher extremes of temperature recorded in Australia are experienced.

Prior to 1961 seven species had been described, and information on the biology of those species was very limited, so that little was known concerning the host associations of *Glycaspis* species. The few hosts recorded with any certainty were:- *Eucalyptus* sp. by Dobson for *G. eucalypti*; *E. leucoxydon* by Schwarz for *G. eucalypti*(?); *E. coccifera* by Froggatt for *G. nigrocineta*; and *E. gomphocephala* by Solomon for *G. occidentalis*.

Subsequent biological studies (Moore 1961, 1961a, 1964, 1964a) provided additional knowledge concerning host associations and the degree of host specificity for some species, and results from this project provide further information on these aspects.

COLORATION

Results from this project have accentuated the unreliability of coloration as a means of differentiating between most *Glycaspis* species.

Seasonal variation in coloration in this genus was brought to the attention of the writer by Dr. T. C. R. White, of the University of Adelaide. Large numbers of specimens collected by him from *E. camaldulensis* in the Botanic Park, Adelaide, during the months of June and July, 1967, were all relatively dark; large numbers collected during January, 1968, were all very pale specimens; and specimens collected during September, 1967, showed either dark or pale coloration, with some intergradation between these two colour categories. On critical examination of the male claspers and aedeagi of the three populations, all specimens were determined as *G. brimblecombei*. Many other species of this genus have also provided indications that such seasonal colour variation is not unusual, although no variation occurred in *G. baileyi* and other species intensively studied for some years by the writer.

LERP AND ALLIED SUBSTANCES

The Aboriginal word "lerp" has been used by a number of writers to denote several different substances, particularly those white exudations associated with trees or insects, and which are sweet to the taste. The early settlers in Australia sometimes referred to these substances as "manna".

Bennett (1834) refers to a substance occurring on leaves, trunks and branches of trees, exuding in liquid form in minute drops, solidifying and falling to the ground, where a large quantity could be collected and eaten by the natives. He reports that the natives called this substance "cuningaban", and that they thought "manna" to be the excrement of cicadas. From the description given by Bennett, it is considered that the substance mentioned by him is not that currently referred to as "lerp", i.e. the numerous kinds and forms of excremental coverings of species of the insect family Psyllidae.

Anderson (1849) gives a concise account of a substance which the Aborigines called lerp, produced by insects on the leaves of the mallee *Eucalyptus dumosa*, and collected during 1849 in the area between lat. 36°20' and 37°10'S., and long. 142°40' and 144°20'E. (i.e. approximately the south-eastern Wimmera District of Victoria, where *E. dumosa* certainly occurs). There appears to be no doubt that a psyllid species belonging to the genus *Glycaspis*, and almost certainly *G. pervagata*, constructed the "conical caps" referred to. This appears to be the first certain reference to lerp associated with the exudation of insects of the genus *Glycaspis*. Anderson's paper was again published in its entirety, immediately after the paper by Dobson (1851).

Dobson (1851) also determined the origin of lerp by establishing that the species *G. eucalypti*, which he briefly described, constructed its sweet covering, or lerp, from an excess of exudation while feeding on the leaves of a *Eucalyptus* sp. at Hobart, Tasmania. He also refers to two different kinds of lerp produced by another two species belonging to genera other than *Glycaspis*.

Bancroft (1869), Wooster (1879) and Tepper (1884) all refer in a general way to this substance or similar substances, as manna, melitose, lerp, honeydew, lac, and wax.

Dixon (1884) gives an abstract of Anderson's paper when referring to the composition and analysis of lerp.

Beveridge (1884) records his observations during the years 1845 and 1846 on "laarp" as a food of the Aborigines.

Schwarz (1898), referring to lerp, follows the interpretation of Anderson.

Froggatt (1900) refers to psyllid coverings as lerps, scales, lerp-scales, leaf-manna, angle sugar, and sugar lerp.

Heslop-Harrison (1949) comments on the analysis of lerp presented by Anderson, the production and forms of lerp, and its presumed survival value to the nymphs.

Moore (1961, 1961a) presented additional information on lerp.

Basden (1966), in a study of the chemistry of these substances, refers to the saccharine secretion from a number of trees of *Eucalyptus* spp. and *Angophora* spp. as manna, which is entirely different in composition from the sugary secretion of aphids, scales, lerps and other insects. He states that manna occurs only on the site of a wound inflicted by an insect. This appears to be the material referred to by Bennett. In another paper, Basden (1966a) refers to *Eurymela distincta* (Signoret) (Homoptera: Eurymelidae) as the "sugar lerp insect". He states that lerp and honeydew are the secretions of an insect which has ingested the phloem sap, extracted the elements it needs, and excreted the remainder with or without change in composition, and that lerp (presumably referring to the secretion of *E. distincta*) is almost completely soluble in water. Lerps of *Glycaspis* spp. are hygroscopic, and are not soluble in water when occurring under natural conditions in the field.

From the above references, Anderson is regarded as being the first to attribute the use of the word lerp to the Aborigines who used this word when they referred to the sweet coverings of *Glycaspis* species.

The application of the word "lerp" by entomologists is now widespread and consistent, so that its usage should be confined to the currently accepted interpretation denoting the various coverings constructed by those insect species of the family Psyllidae of the Homoptera. More appropriate names might then be applied to the varied exudations of numerous insect species belonging to other families, and of trees.

The shapes of lerps and the subgenera to which the species belong, indicate a lengthy evolutionary process in the formation of the genus *Glycaspis*.

Because of time limits during this project, it was not possible to determine the lerp shape associated with all of the species obtained, and the rearing of adults from discrete lerps was restricted, so that general indications given by the presence or absence of a particular lerp shape, had to be relied on when interpreting the phylogeny of some species.

An estimate of the approximate numbers of species associated with each lerp shape within the genus is:- galls 15; flat lerps 5; round lerps in *Synglycaspis* 16; round lerps in *Glycaspis* 55; oval lerps 16; rectangular lerps 5. There are also 12 species in the subgenus *Boreioglycaspis*, none of which construct lerps.

It has recently been reported that a lerp-forming psyllid species of the genus *Pachypsylla* occurs in Japan (Miyatake 1968), and that both galls and lerps are formed by this one species.

Capener (personal communication 1969) knows of only one lerp-forming psyllid in South Africa, i.e. *Arytaina mopani* Pettey.

INDICATIONS OF PARTHENOGENESIS

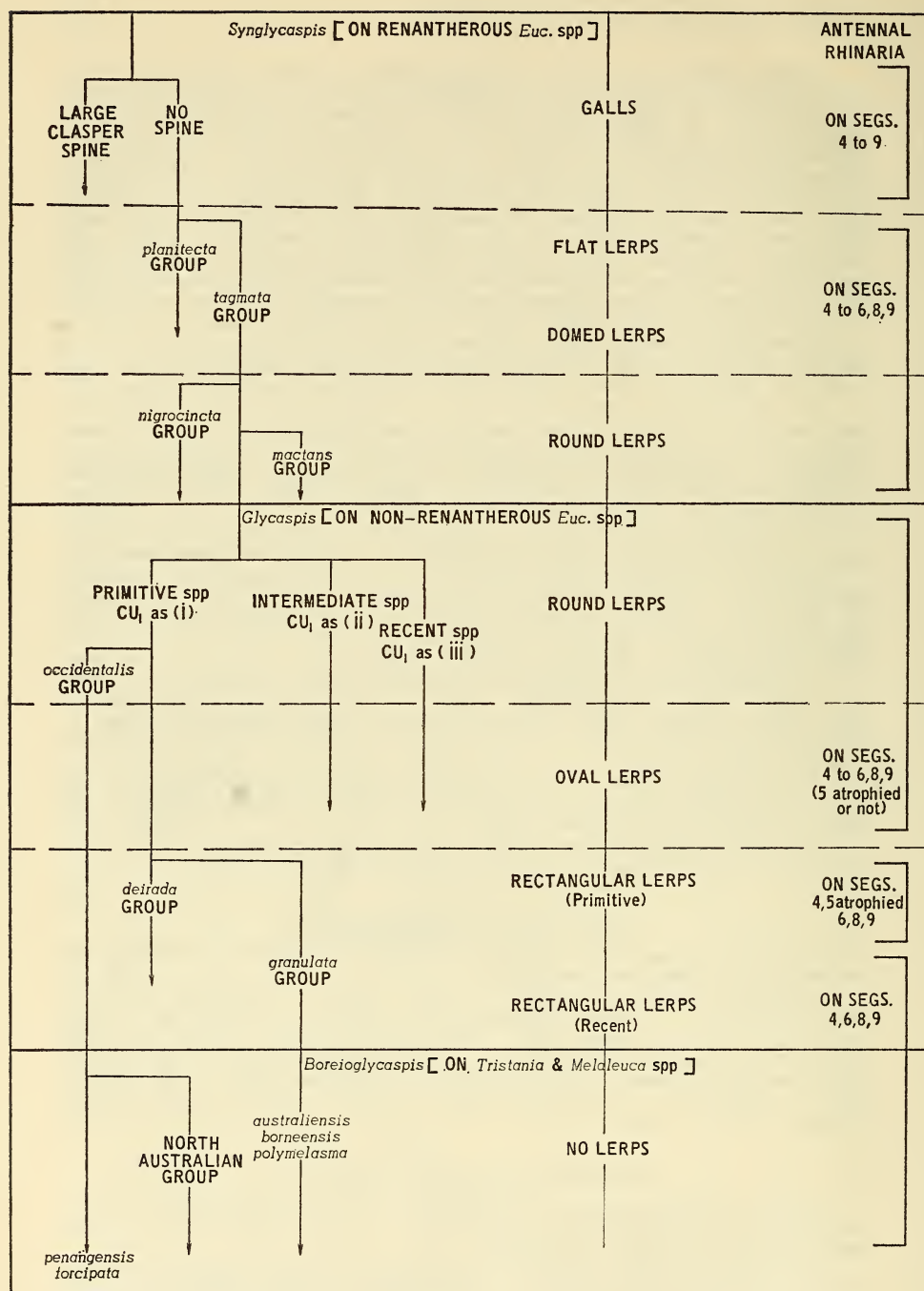
Biological studies to determine if parthenogenesis occurs within the genus apparently have not been made.

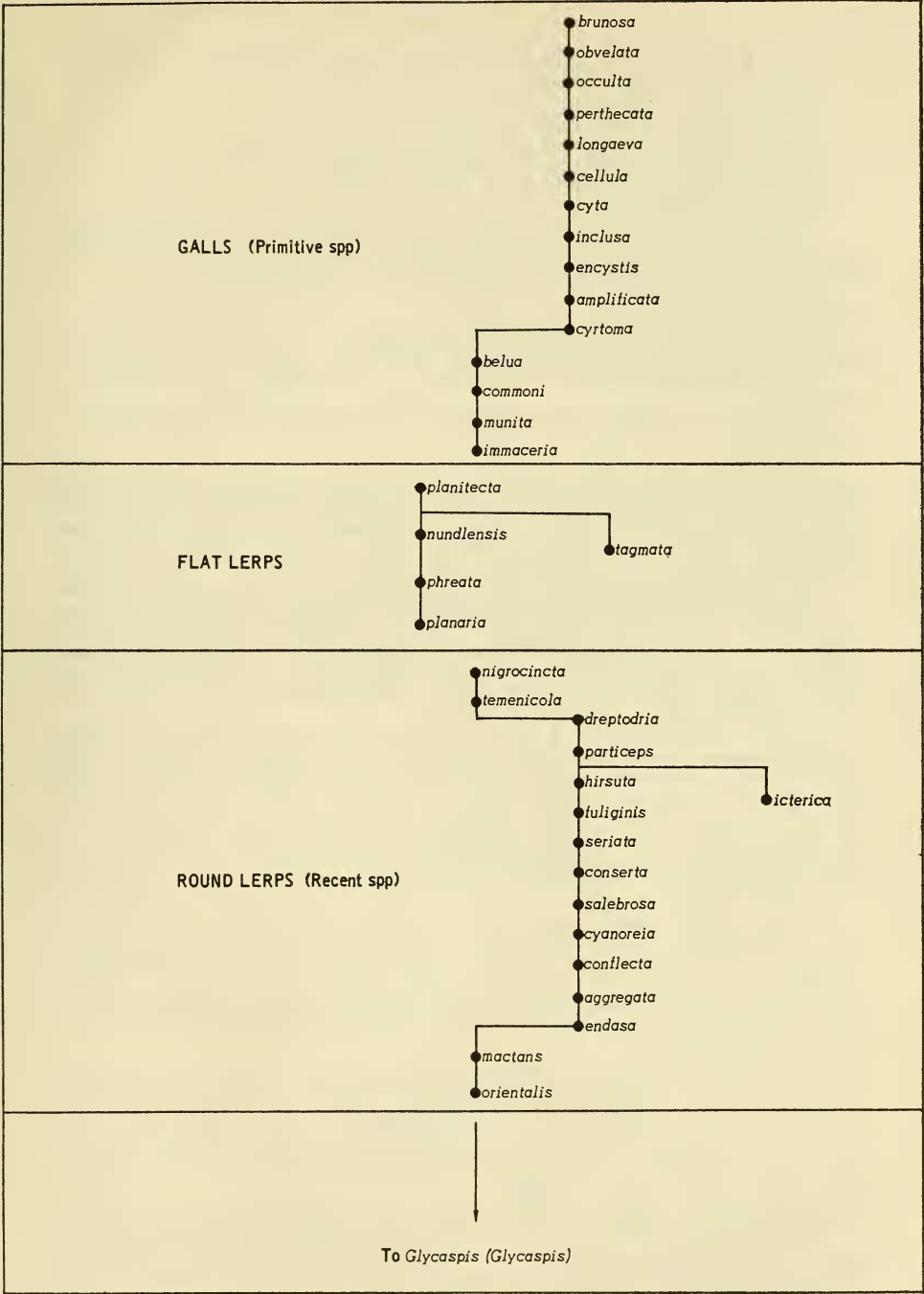
Indications that the females of some species of *Glycaspis* reproduce parthenogenetically, at least seasonally, were obtained during this project, for the males of some species either have not been obtained or have been most difficult to obtain, although intensive and extensive collections were made. These indications were most noticeable in the drier areas of the inland, and the relatively dry subtropical northern portion of the continent during winter.

PHYLOGENY OF THE GENUS GLYCASPIS

Various interpretations of the phylogeny of any biological group are no doubt possible when knowledge concerning the group is limited, as is the case concerning the genus *Glycaspis*.

The genus at present consists of the three subgenera *Synglycaspis*, *Glycaspis* and *Boreioglycaspis*, which indicate its evolutionary sequence. Specific characters which might be utilised as a basis on which their phylogeny could be interpreted assumed varying importance during this study and it was determined that all known characters need to be considered together.

Figure 1. Presumed phylogeny of the genus *Glycaspis*.



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Figure 2. Presumed phylogeny of the subgenus *Synglycaspis*.

The separation of the three subgenera, and the presumed phylogeny of the genus, are based on information pertaining to the following aspects:-

1. Nymph product (i.e. gall, lerp) and the lerp shape.
2. Antennal segments on which the rhinaria occur.
3. Morphological characters of the male aedeagi and claspers.
4. Length of M+Cu stem in the forewing venation.
5. Shape and length of vein Cu₁ of the hindwing.
6. Host associations.

It is assumed that most of the lerp shapes recorded, and the identifications given for the host species, are correct, but some inaccuracies no doubt have occurred in this extensive project concluded in a limited time.

The presumed phylogeny of the genus as a unit is presented in figure 1. *Glycaspis* (*Synglycaspis*)

The stem of M+Cu in the forewing venation is always short, and the vein Cu₁ of the hindwing of all known species is as that shown in figure 4.

The presumed phylogeny of species in this subgenus is presented in figure 2.

Each species utilises as its host, one or more of the renantherous species of *Eucalyptus*.

The 36 species in this subgenus are considered to be the most primitive within the genus, and construct galls, flat lerps, and round lerps. The phylogeny of the species is indicated by these characteristics, the species forming galls being the most primitive group; those constructing flat lerps the intermediate group; and round lerp-forming species the most recent. The antennal rhinaria also indicate the relative antiquity of this subgenus.

The gall-forming species appear to be the group most readily separable into species on the adult male morphological characters, and on the presence or absence of a large basal spine on each of the male claspers they are separable into two subgroups. The most primitive species, with the largest basal spine on each clasper, are *G. brunosa*, *G. obvelata* and *G. occulta*. The most recent species, without large basal spines on the claspers, are *G. belua*, *G. commoni*, *G. munita* and *G. immaceria*.

Species constructing flat lerps are often separable only when some details of their biology are known. They possess the most homogeneous adult morphological characters of any group within the genus. At present, they are separable into two groups on the texture of their lerps. One group constructs lerps of fine texture which are in the same horizontal plane as the leaf surface, and cover the nymph in a relatively deep depression in the leaf; the other group constructs relatively coarse-textured lerps which rise above the leaf surface, to cover the nymphs which feed in a shallow depression in the leaf surface.

Species constructing round lerps are difficult to separate on the adult male morphological characters alone, but three subgroups, two of which exhibit evolutionary divergence based on characters of the male aedeagi and claspers, are evident. One divergent group consists of two species utilising *E. coccifera* and *E. linearis* respectively, as their host. The other group, also of two species, utilises *E. acmenoides* and *E. umbra* as their respective host.

Glycaspis (*Glycaspis*).

As with the species in *Synglycaspis*, lerp characteristics and the antennal rhinaria provide an indication of the phylogeny of those species which suggest a discrete line of evolution within this subgenus, i.e. species constructing round lerps are the most primitive and form a link with the species constructing round lerps in *Synglycaspis*; species constructing oval lerps are the intermediate group; and species constructing rectangular lerps are the most recent in a discrete line of evolution within the subgenus.

The presumed phylogeny of species in this subgenus is shown in figure 3.

Each species utilises one or more of the non-renantherous *Eucalyptus* spp. (excluding Series iv and v) as its host, while more than one *Glycaspis* species may utilise a *Eucalyptus* species which at present is considered to be a discrete species.

Species constructing round lerps in this subgenus showed intergradation in the length and shape of the vein Cu₁ of the hindwing, which necessitated

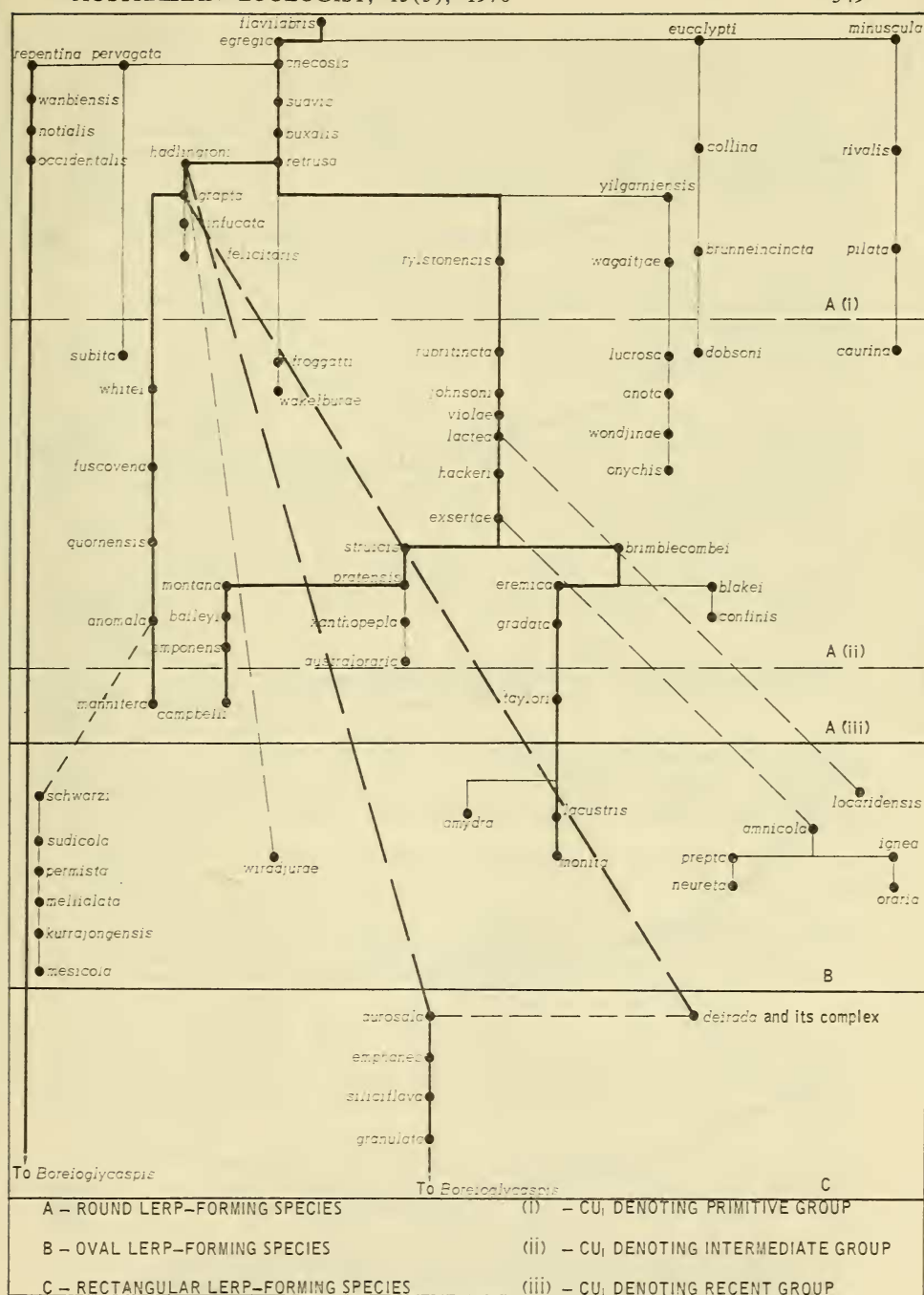


Figure 3. Presumed phylogeny of the subgenus *Glycaspis*.

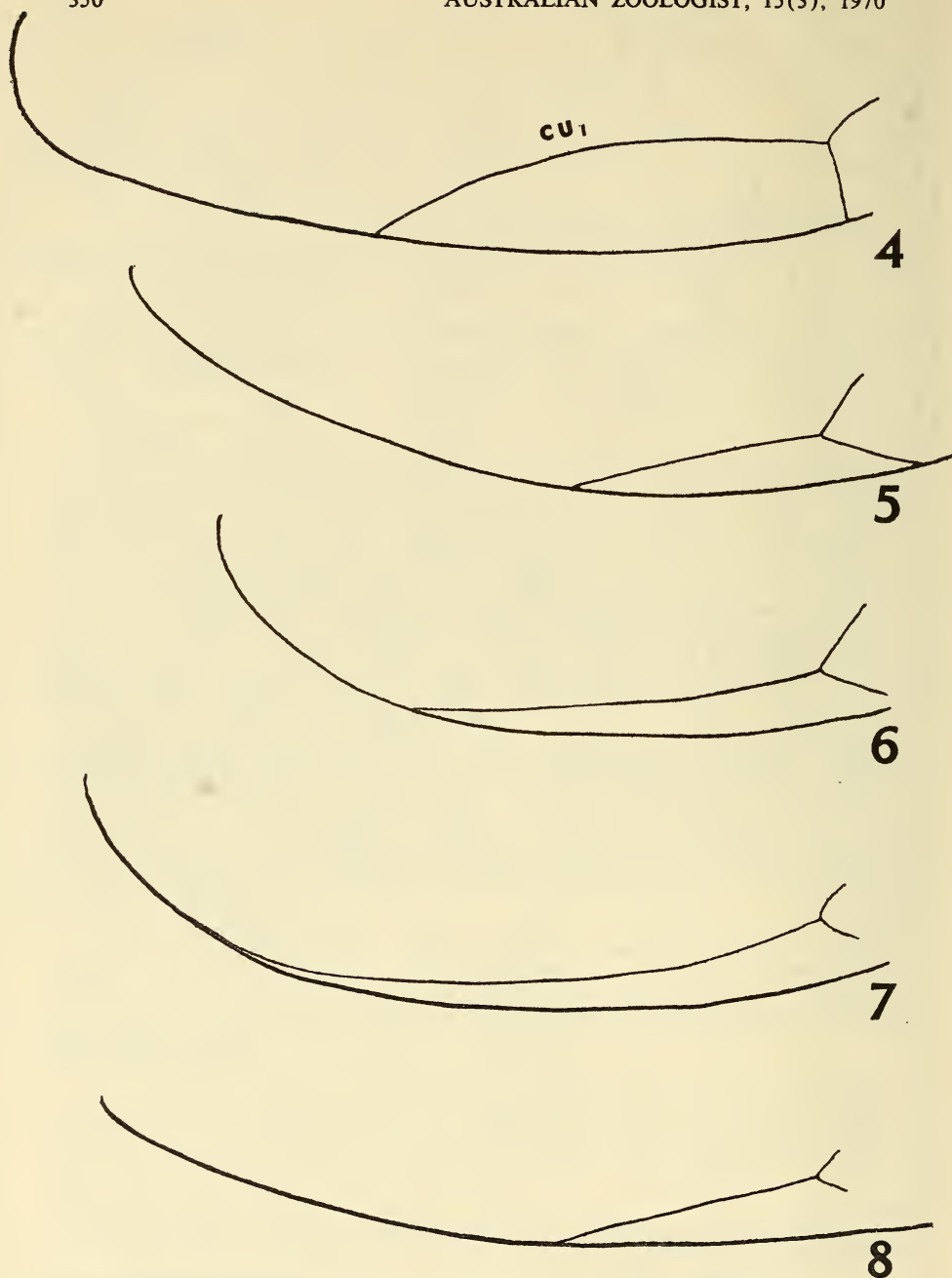


Figure 4. Shape of hindwing vein Cu_1 , subgenus *Synglycaspis*.
Figure 5. Shape of hindwing vein Cu_1 , subgenus *Glycaspis*, Group (i).
Figure 6. Shape of hindwing vein Cu_1 , subgenus *Glycaspis*, Group (ii).
Figure 7. Shape of hindwing vein Cu_1 , subgenus *Glycaspis*, Group (iii).
Figure 8. Shape of hindwing vein Cu_1 , subgenus *Boreioglycaspis*.

the separation of species into three arbitrary groups based on the length and general shape of that character. Measurements were made along a straight line parallel with the long axis of the wing, and from the commencement of the vein at the cell base to its termination at the edge of the wing.

In Group (i), the shorter Cu_1 venation is similar to that in Text-figure 5 and may vary in length from 0.047 mm. to 0.115 mm. As the vein lengthens, it becomes similar to that of Group (ii) specimens (figure 6), and may vary in length from 0.115 mm. to 0.162 mm. Eventually, the vein assumes a shape similar to that of Group (iii) specimens (figure 7), and may vary in length from 0.162 mm. to 0.207 mm.

The shorter venation indicates the most primitive species, and the longer venation the more recent species.

The short stem of the veins $M+Cu$ on the adult forewings of *G. flavilabris* which is considered to be the most primitive species in Group (i), appears to represent a link between the subgenera *Synglycaspis* and *Glycaspis*, and also indicates the close affinities of *G. flavilabris* with the species *G. eucalypti* and *G. minuscula*. These three species appear to represent evolutionary divergences within the subgenus *Glycaspis*.

The progressive lengthening of vein Cu_1 is also correlated with a progressive protrusion of the basal one-third, or "foot" portion, of the male claspers, so that species of more recent phylogeny possess the longer Cu_1 vein together with the more extended "foot" near the base of the claspers. These two characters provide the sequence adopted in the taxonomic paper.

Among the round lerp-forming species, those in Group (i) possess scimitar-shaped claspers; four species in Group (ii) possess that characteristic, and no species with claspers of that shape occur in Group (iii).

The subgenus *Glycaspis*, containing 79 species, is thus the most complex of the three subgenera. Prolific speciation and widespread dispersal have been characteristics of the subgenus, and speciation appears to be current in some species.

The *occidentalis* group of species (see Moore 1964, p. 151) bear scimitar-shaped claspers, and construct round lerps; vein Cu_1 of the hindwing is similar to that in figure 5, i.e. Group (i) of the round lerp-forming species of *Glycaspis* (*Glycaspis*).

It is thus evident that this group diverged at an early stage in the evolution of the subgenus *Glycaspis*, the morphology of the aedeagi and claspers suggesting that divergence was from the widespread southern species *G. pervagata*. Species provisionally included in the group are *buxalis*, *repentina*, *wanbiensis*, *notialis*, *occidentalis*, *wagaitjæ*, *wakelburæ*, and possibly *johnsoni*, *violæ*, *hackeri* and *suavis*.

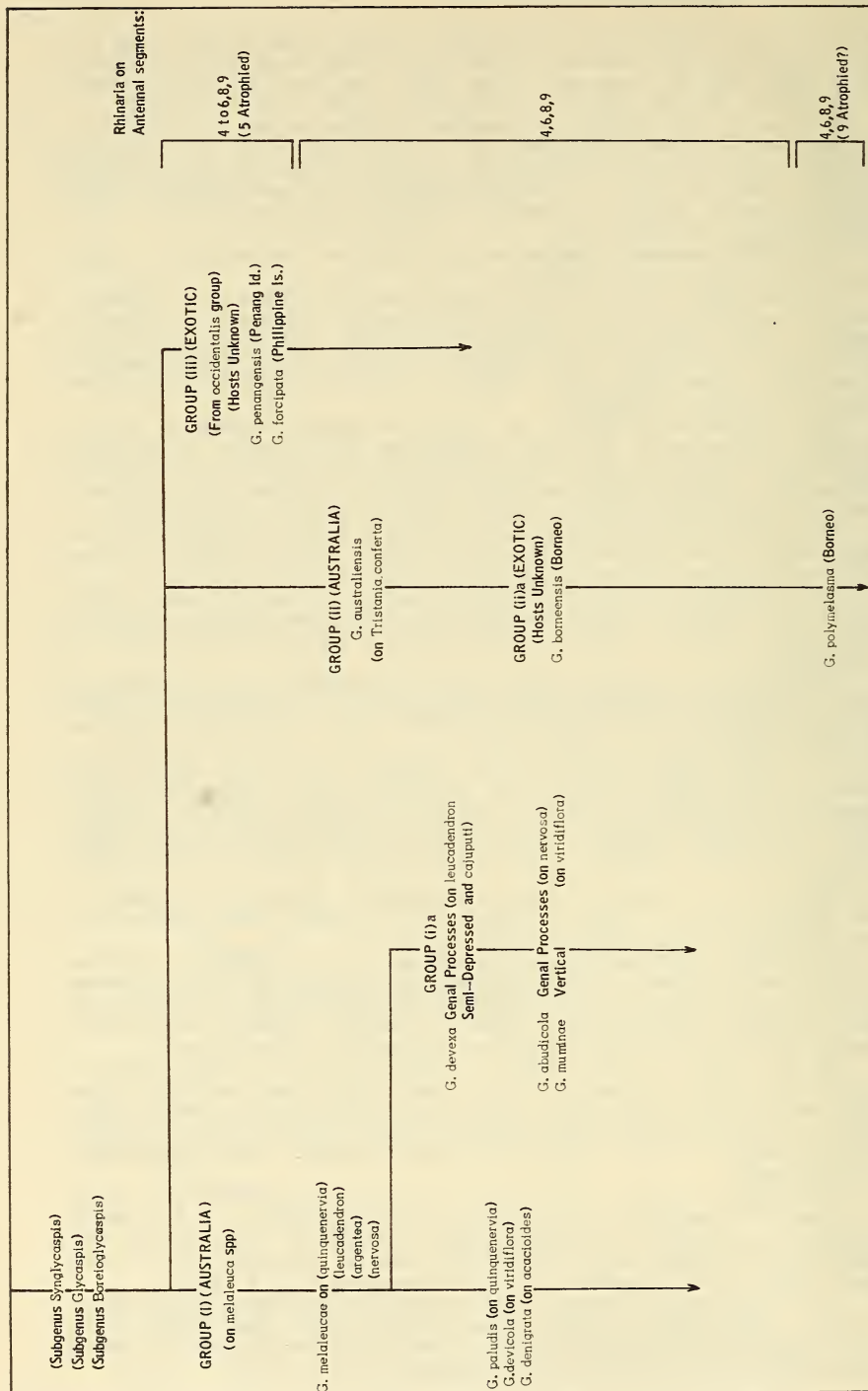
The species *G. johnsoni*, because of distinctive clasper shape, appears to have affinities with *G. violæ*, *G. lactea* and *G. hackeri*. These species may represent further evolutionary divergence.

Indications of their phylogeny are considered to be fragmentary, because of the probable extinction of some *Glycaspis* spp. during evolutionary processes, or because some species of possible value to a more accurate interpretation of their phylogeny are not known. There is also the possibility of incorrect identification of a host plant, or incorrect interpretation of lerp shape.

The lerp shape of some species in Group (i) is not known, and it is possible that some may construct round to oval lerps. Those particular species would then provide a link with the more recent rectangular lerp-forming species which also possess scimitar-shaped claspers together with the short Cu_1 vein. *G. graptæ* might well be a species from which rectangular lerp-forming species have originated.

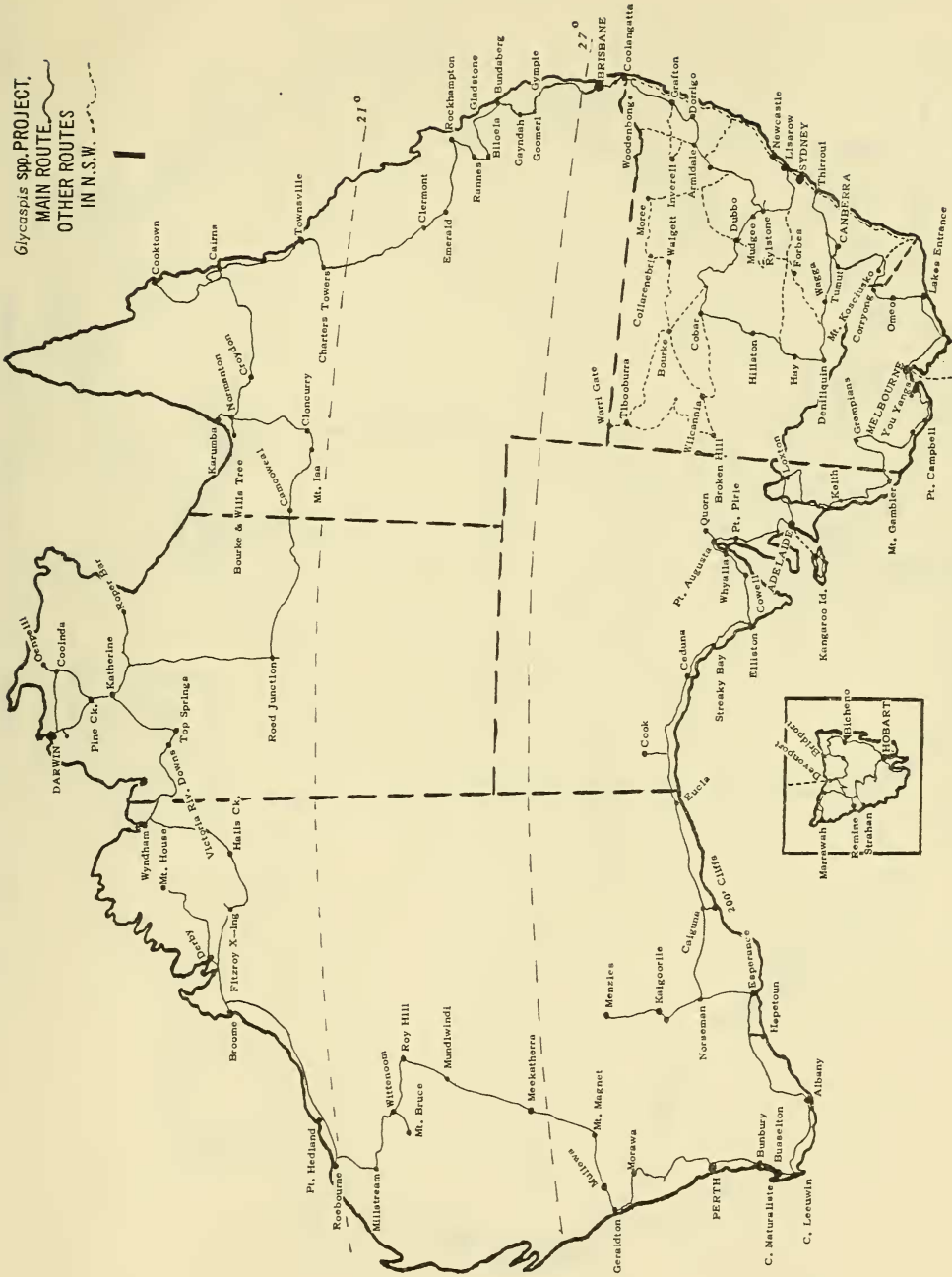
The rhinaria on the antennae of the rectangular lerp-forming species, *G. aurosala*, *G. emphanes* and *G. deirada*, occur on segments 4, 5, 6, 8 and 9, with that on segment 5 atrophied, while rhinaria on other species also constructing rectangular lerps (*G. siliciflava* and *G. granulata*, the two most recent species in the subgenus), occur on segments 4, 6, 8 and 9.

There are thus two groups of *Glycaspis* spp. constructing rectangular lerps, with the latter group of more recent phylogeny than the former group. Common characters of species in both of these groups are the scimitar claspers and the shape of the vein Cu_1 of the hindwing.

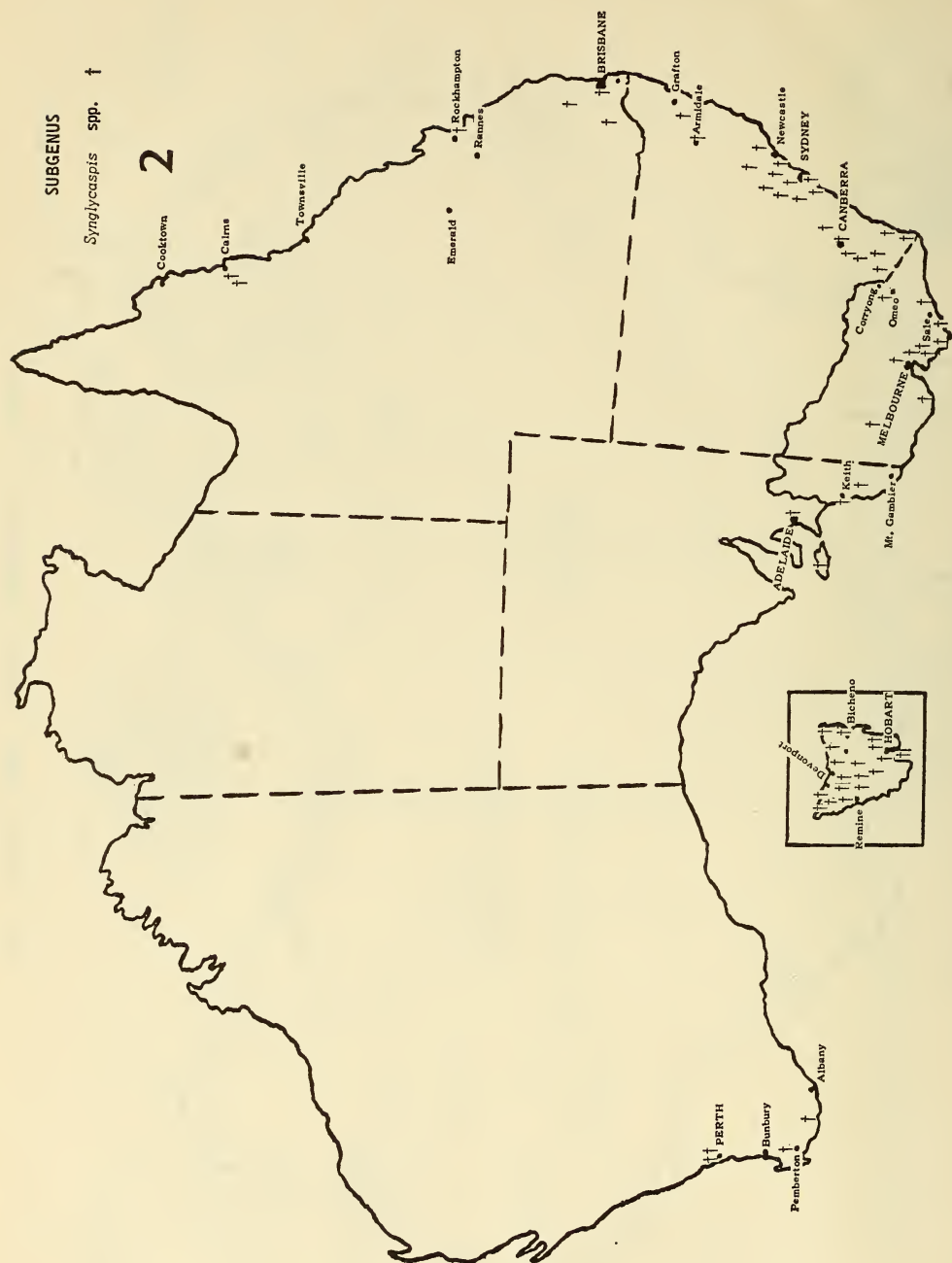


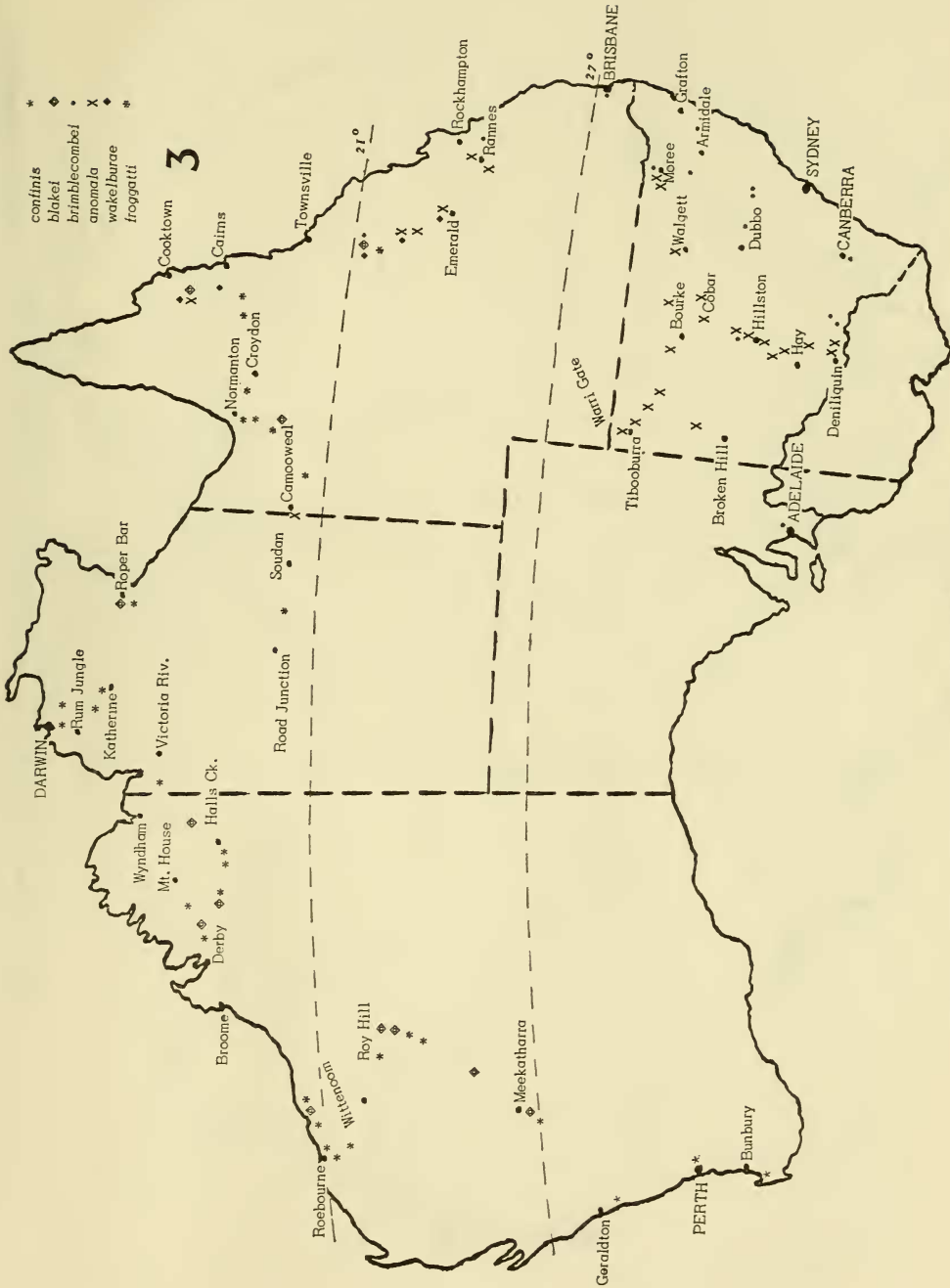
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Figure 9. Presumed phylogeny of the subgenus *Boreioglycaspis*.



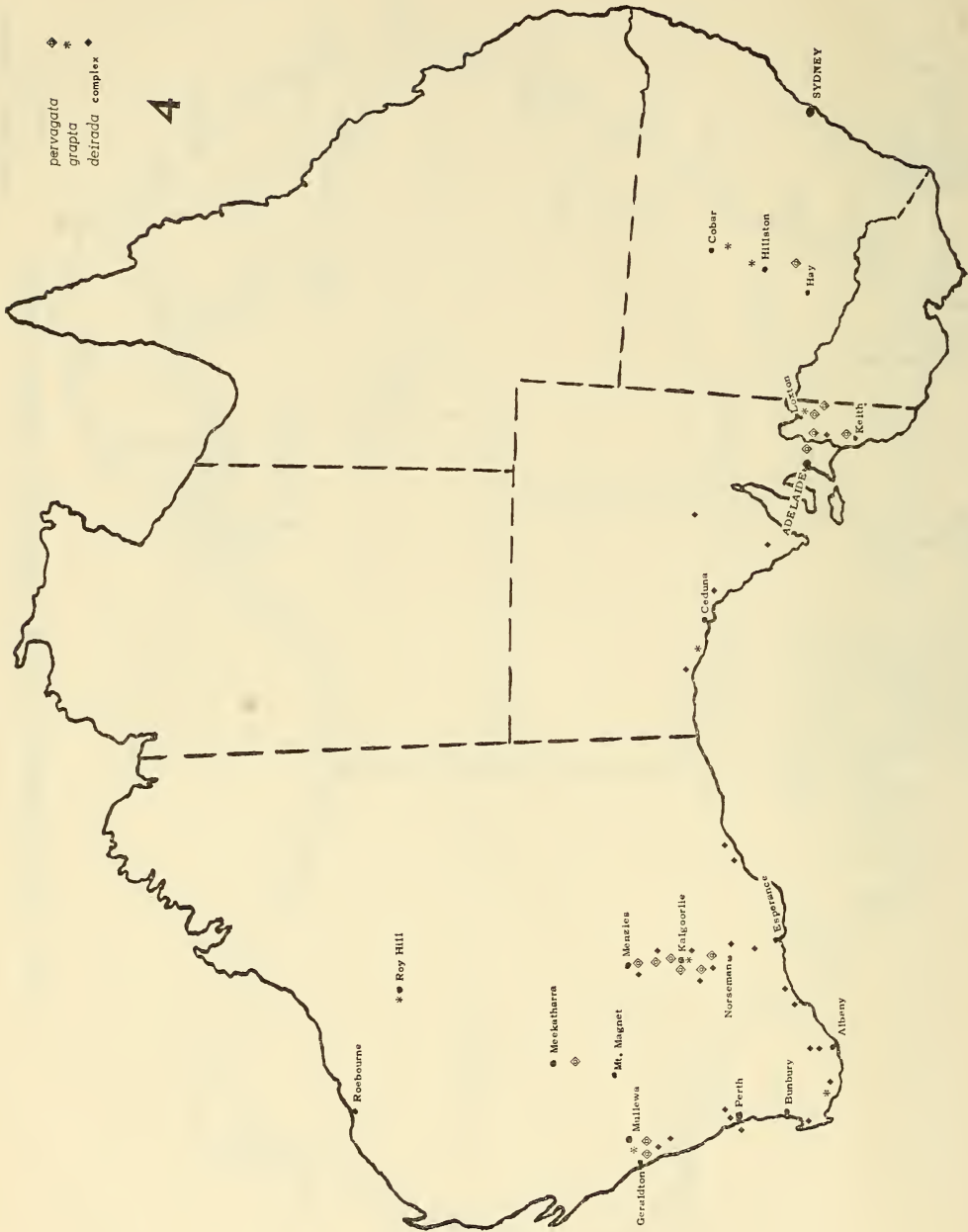
Map 1. Route followed during investigations on *Glycaspis* spp.



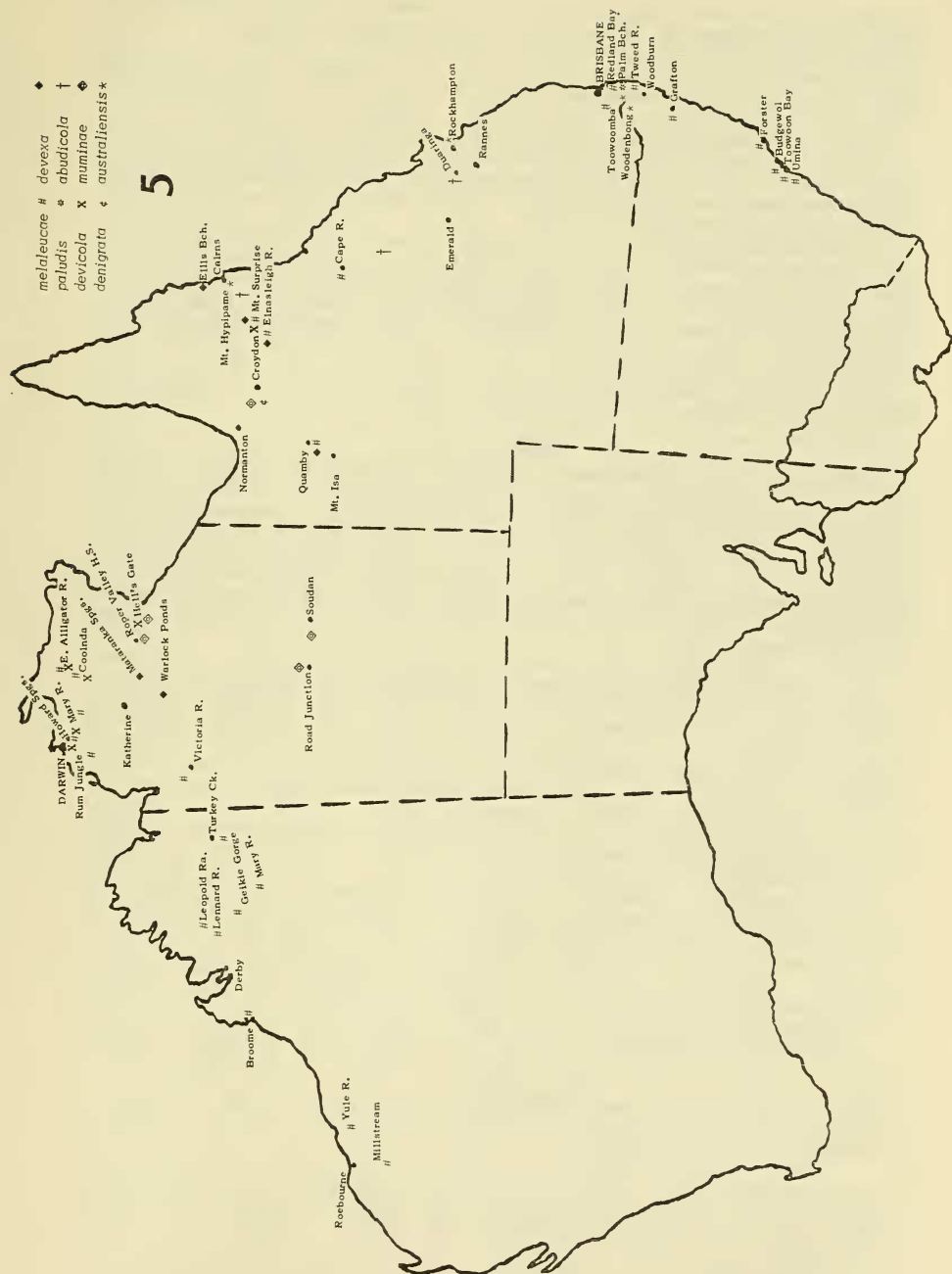


Map 3. Known distribution of some species in the subgenus *Glycaspis*.

(northern dispersal)



Map 4. Known distribution of some species in the subgenus *Glycaspis* (southern dispersal)



Map 5. Known distribution of some species in the subgenus *Boreioglycaspis*

It is indicated that some species forming rectangular lerps acquired that habit at an early stage in the evolution of the subgenus *Glycaspis*.
Glycaspis (*Boreioglycaspis*).

The shape of the hindwing vein Cu_1 on specimens in this subgenus approximates that shown in figure 8, and the length of the vein is relatively stable.

The presumed phylogeny of species in this subgenus is shown in figure 9.

There is no evidence that species in this subgenus form lerps or galls, although some species on *Melaleuca leucadendron* or *M. quinquenervia* at times produce a quantity of white flocculence among the young shoots of the host plant where they usually feed.

There appear to be five arbitrary groupings within the subgenus:- (a) the single species *australiensis* with closest affinity to the subgenus *Glycaspis*; (b) the *melaleucae* group, of species which have retained more or less prognathous genal processes; (c) one species with genal processes deflexed; (d) two species with vertical processes; (e) the two known exotic species *penangensis* and *forcipata* which, from the shape of the wing, appear to have diverged from the *occidentalis* group of species.

For a clearer understanding of the evolutionary sequence in the genus *Glycaspis*, more detailed studies are necessary.

DISTRIBUTION

Synglycaspis spp. predominate in Tasmania and in the south-east of the mainland, with a pattern of dispersal northwards through the relatively narrow coastal and tablelands region, with one species reaching at least to Cairns, in Queensland, and with an isolated population of one species in the south-western corner of Western Australia (Map 2). No specimens of this subgenus were collected on the mainland between Adelaide, in South Australia, and Deep River, in Western Australia, although they were obtained from Kangaroo Island, in South Australia. Five of the six most primitive gall-forming species occur in Tasmania.

Such a distribution pattern, and concentration of numbers of species, together with the presence of 5 of the six most primitive gall-formers in Tasmania, might indicate that the subgenus originated in Tasmania and spread northwards and westwards after reaching the mainland. The single Western Australian species appears to have reached that State prior to the onset of aridity which now divides the southern half of the continent, and which severely restricts, or possibly prohibits, the natural dispersal of biological units from the east to the west across southern Australia.

No species of *Synglycaspis* constructing galls or flat lerps were obtained from Western Australia, and only three species of the subgenus *Glycaspis* have been collected in Tasmania.

In the subgenus *Glycaspis*, more or less continuous distribution patterns over wide areas are apparent for a number of species, i.e. a southern dispersal from N.S.W. to Western Australia for *G. pervagata* (see Map 4), and a northern dispersal from Queensland to Western Australia for *G. froggatti* and *G. blakei* (see Map 3), although some species appear to be very localised (i.e. *G. cnecostia*, *G. caurina*, etc.) or may be confined to widely separated areas where their host occurs (i.e. *G. lucrosa*, *G. anota*, etc.).

The three most primitive species, *G. flavilabris*, *G. eucalypti* and *G. minuscula*, occur from Rylstone in N.S.W. to Hobart in Tasmania, and this appears to represent the earliest dispersal of species in the subgenus. On present knowledge, their general distributions are:- from Rylstone to Canberra (*G. flavilabris*), from Kiandra to Hobart (*G. eucalypti*) and from Goulburn to Melbourne (*G. minuscula*).

A second apparent dispersal, by species of close affinities with the three abovementioned species, seems to have been northwards from the Rylstone-Canberra area, to the Brisbane-Calliope area in Queensland, and across the north of the continent to Port Hedland, in Western Australia (*G. suavis*, *G. buxalis*).

A third apparent dispersal, perhaps during the same time-period as the second, seems to have been across the south of the continent from central N.S.W. to Roy Hill in Western Australia (*G. pervagata*, *G. grapta*, Map 4).

After considerable speciation in the area between Adelaide and Rylstone (*rivalis*, *pilata*, *whitei*, *fuscovena*), a proliferation of species whose origins appear to have been in the northern areas of the continent seems to have occurred (*wagaitjae*, *lucrosa*, *anota*, *wondjinae*, *onychis* and *froggatti*), with their dispersal in both easterly and westerly directions across the north. The western dispersal (*G. froggatti*) reached Western Australia and thence southwards, to intermingle with a species of the third dispersal (*G. pervagata*) which had moved northwards in Western Australia to Nannine, where both *froggatti* and *pervagata* occur together on *E. striatocalyx*.

Speciation and dispersal of the species *blakei*, *eremica*, *gradata* and *brimblecombei*, which are of close affinities, and *xanthopepla*, *pratensis*, *australoraria* and *strucis* then appear to have occurred in the north and east of the continent.

G. blakei seems to have originated in the northern areas of the continent, dispersing west and south to Meekatharra in Western Australia, and east and south to the Clermont area in Queensland. From the Clermont area, *G. brimblecombei* on *E. camaldulensis* and other species, appears to have evolved from *G. blakei* and dispersed southwards to the Adelaide area in South Australia. Near Perth, Western Australia, *G. confinis* also appears to have evolved from *G. blakei* and dispersed southwards to the Albany area. Further speciation then seems to have occurred in the general area between Rockhampton-Clermont in Queensland, to Adelaide in South Australia, and more recently in the eastern coastal and tableland regions of southern Queensland to southern New South Wales (*montana*, *baileyi*, *imponens*, *campbelli*).

By this time, the oval lerp-forming species appear to have evolved. They have only been collected within the general area Clermont in Queensland to Quorn in South Australia.

Rectangular lerp-forming species appear to have originated, and attained their most recent stage of evolution, in the eastern areas, and show a relatively early dispersal in two directions, both northwards to the Clermont area and westwards across the south of the continent to the southern areas of Western Australia.

No species constructing rectangular lerps have been obtained from Tasmania, Victoria or the Northern Territory, although it is likely that some occur at least in Victoria.

The more recent rectangular lerp-forming species *G. siliciflava* and *G. granulata* have a known distribution from Sussex Inlet (near Nowra, N.S.W.), to Mt. Spec (near Cairns, Queensland). It is in this area that the more primitive species of *Boreioglycaspis* appear to have evolved. *G. australiensis* with closest affinities to the subgenus *Glycaspis*, occurs on *Tristania conferta*; and *G. melaleuca* occurs on four *Melaleuca* species. The known distribution of the former species is confined to the Queensland-N.S.W. border area and northwards to Cairns; the latter species shows a continuous distribution from the Hawkesbury River (30 mi. N. Sydney) northwards through the coastal areas and across the continent to near Roebourne, Western Australia (see Map 5). Further speciation in *Boreioglycaspis* occurred on various *Melaleuca* spp. which are distributed across northern Australia.

Extensive collecting in Papua-New Guinea, and throughout the Indonesian chain of islands to the west, should indicate the route of dispersal of *Boreioglycaspis* spp. from Australia to Borneo and the Philippine Islands.

HOST ASSOCIATIONS

Until recent years, records of insect/host associations in Australian entomology had been neglected or almost non-existent, so that the record of host associations of this discrete genus appears to be unique.

During previous investigations on the *Glycaspis* spp. host associations (Moore 1961) when little was known concerning this aspect, it was considered that a very restricted, or even discrete, host association was usual for most of the species. More recent extensive collecting has shown an increased number of hosts for some discrete *Glycaspis* species, and it appears that most species will eventually be found to occur on more than one host plant species when their associations are better known.

Species/Host associations, are presented alphabetically in Tables 2 and 3 respectively.

Some species are widely distributed, while others are of local distribution (see Table 1); the former species usually are associated with a number of host species, while the latter appear to be more or less host specific.

As *Glycaspis* spp. ingest the sap of their host plants it appears that certain available chemical compounds in their food would be critical to the survival, or mortality, of certain species or groups of species on certain hosts. Some of the widely distributed species are apparently more tolerant to a greater range of chemical components (evident from their more numerous host associations), and the localised species less tolerant (evident from their relative host specificity).

During this study it was found that the *Glycaspis* sp. obtained from a certain host has reliably indicated the host plant species or a species of affinities with it, e.g. *G. baileyi* from *saligna*, *resinifera* and *robusta*; *G. whitei* from *polyanthemos* and *fasciculosa*; etc.

In contradistinction to those examples, there are also a number of discrete *Glycaspis* species utilising a single widespread host species, e.g. *G. brimblecombei*, *G. blakei*, *G. eremica* and *G. gradata* all utilising *E. camaldulensis* as their host.

Limited feeding trials with nymphs of *G. baileyi* on *Angophora floribunda* and *E. acmenioides* showed that they apparently could not survive on these species (Moore 1961).

The completion of the life-cycle of *G. baileyi* on *E. camaldulensis* (its normal host is *E. saligna*) suggests a similarity between the chemical composition of the leaves of both these eucalypt species. However, the *E. camaldulensis* plants were grown in an area atypical of their natural habitat and in an area where *E. saligna* occurs naturally, so that possibly the chemical composition of the plant might also have been atypical, by virtue of its altered environment.

Glycaspis spp. have now been obtained from approximately 133 *Eucalyptus* spp.; an additional 45 eucalypt species were sampled, but no *Glycaspis* spp. were obtained; thus about 180 *Eucalyptus* spp. have been sampled for *Glycaspis* spp. during, and prior to, this project.

No *Glycaspis* spp. were obtained from the following eucalypt species, and the extent of collecting is indicated by the following suffix letters:- E = extensive (several areas); M = moderate (few areas); R = restricted (one or two areas). The prefix numbers in parentheses are those of the relevant species in Blakely's "Key" (1955).

(1) <i>erythrocorys</i> R	(29) <i>foelscheana</i> M	(296) <i>pachyloma</i> R
(2) <i>tetragona</i> E	(32) <i>calophylla</i> M	(298) <i>todiana</i> R
(3) <i>eudesmioides</i> ... M	(36) <i>ficifolia</i> R	(299) <i>patens</i> R
(5) <i>ebbanoensis</i> R	(42) <i>terminalis</i> E	(301) <i>buprestium</i> R
(6) <i>odontocarpa</i> M	(43) <i>cliftoniana</i> R	(305) <i>guilfoylei</i> R
(12) <i>baileyana</i> R	(45) <i>gummifera</i> E	(314) <i>microcorys</i> E
(16) <i>tessellaris</i> M	(50) <i>eximia</i> M	(447) <i>decipiens</i> M
(17) <i>papuana</i> M	(53) <i>citriodora</i> R	(449) <i>lansdowneana</i> .. R
(18) <i>grandifolia</i> M	(54) <i>maculata</i> E	(525) <i>pruinosa</i> E
(19) <i>clavigera</i> E	(85) <i>cosmophylla</i> ... R	(567) <i>cneorifolia</i> E
(19a) <i>confertiflora</i> ... E	(94) <i>grossa</i> R	(568) <i>micranthera</i> M
(20) <i>gilbertensis</i> R	(108) <i>macrandra</i> R	(599) <i>macrocarpa</i> M
(21) <i>aspera</i> E	(158) <i>goniantha</i> R	(600) <i>pyriformis</i> R
(22) <i>setosa</i> R	(168) <i>falcata</i> R	(602) <i>pachyphylla</i> M
(26) <i>dichromophloia</i> E	(171) <i>erythronema</i> ... R	(605) <i>kingsmillii</i> R
	(247) <i>megacarpa</i> R	

DISCUSSION ON THE SIGNIFICANCE OF GLYCASPIS SPP. HOST ASSOCIATIONS

Although this project is primarily an entomological investigation, it is considered that the host associations of some *Glycaspis* spp. studied might provide information of value in any reassessment of the phylogeny of the genus *Eucalyptus*.

Some aspects of Blakely's classification of *Eucalyptus* spp. are apparently unsatisfactory because of more recent information presented by workers in various disciplines. Blake (1953) studied Northern Australian species; Ingle

& Dadswell (1953) examined the anatomy of wood; Chattaway (1955) utilised the anatomy of bark; Pryor (1959) studied the evolution of the genus; Gauba & Pryor (1958, 1959, 1961) utilised seed-coat anatomy; Carr & Carr (1962, 1962a) used vegetative and floristic characters; Johnston & Marryatt (1965) listed previously published corrections to the classification of the genus; Hillis (1966, 1967, 1967a) examined the relationships of the polyphenolic composition of the leaves, and Banks & Hillis (1969) intensively investigated the polyphenols in leaves of *E. camaldulensis* throughout its range. Pryor & Byrne (1969) studied patterns of variation in *E. camaldulensis*.

The following information is presented with the knowledge that an insect/host association does not necessarily indicate the phylogeny of the host-plant group, but when the insect/host associations of the single genus *Glycaspis* are considered, it then appears that certain limited indications of the eucalypt phylogeny, based on those associations, might be of value.

In this discussion, certain information concerning the phylogeny of the *Glycaspis* spp. is recorded, and by correlation of this information with their host associations, some additional knowledge concerning the phylogeny of the eucalypt group might be indicated.

There seems to be no evidence which suggests a particular period in time at which the inception of the genus *Glycaspis* occurred in Australia, nor any information as to the evolutionary development attained by the genus *Eucalyptus* by that time.

It has been suggested that evolutionary divergence within the genus *Glycaspis* at the subgeneric level, might indicate evolutionary divergence within the genus *Eucalyptus* (Moore 1961), and the numerous host associations determined during this project have supported this suggestion.

From a study of the evolutionary relationships of butterflies and their food plants, Ehrlich & Raven (1965) obtained little information useful for the reconstruction of phylogenies. They proposed a comparable pattern of adaptive radiation for each of the limited groups of butterflies studied, and concluded that secondary plant substances play the leading role in determining patterns of utilisation by the various groups. It appears that *Glycaspis* spp. also follow a similar general pattern of evolutionary relationships with their food plants, with a pattern of adaptive radiation evident in some groups.

The possibility of incorrect identifications of some hosts, or misinterpretations of lerp shape of some *Glycaspis* spp. during this project is again emphasised here. Detailed collection localities for the *Glycaspis* spp. are given in the taxonomic paper.

The following discussion is based categorically on Blakely's Series groups in the genus *Eucalyptus*; figures in parentheses refer to his species numbers.

Series iv & v. *Corymbosae* (& *Clavigerae* of Blake).

It is of interest to find that no *Glycaspis* spp. have been correlated with any of the eucalypts in these Series, species numbers (16) to (55) inclusive. Of the 18 *Eucalyptus* spp. investigated, seven were sampled extensively, six moderately and five restrictedly.

The absence of *Glycaspis* spp. may indicate that the chemical components of the leaves are not suitable for the survival of *Glycaspis* spp., and that this eucalypt group may represent an evolutionary divergence within the genus. On the negative evidence of the consistent absence of *Glycaspis* spp. from either this eucalypt group or the genus *Angophora*, it is suggested that there may be affinities between these two groups. These indications are in accord with those of Gauba & Pryor (1961), and with Ingle & Dadswell (1953) who record that "Timbers of the *Corymbosae* Non Peltatae and *Corymbosae* Peltatae are very similar to those of the genus *Angophora*, and anatomically it is difficult to distinguish between them".

Species of the psyllid genus *Eucalyptolyma* consistently utilise a number of *Angophora* and corymbose eucalypt species as well as other eucalypt species as their hosts, and a study of these psyllid associations may provide information relevant to the phylogeny of the eucalypt and *Angophora* groups.

Series xxiii-xxxiv, *Renantheroideae*, *Renantherae*, *Renantherae* (Normales).

It appears to be of some importance that species of the most primitive subgenus *Synglycaspis* utilise as their hosts only those species of *Eucalyptus*

contained in these Series (with the possible exception of *E. rodwayi*), and apparently are unable to survive on non-renantherous species. It is from these host associations of *Glycaspis* spp. at the subgeneric levels that an evolutionary divergence of the renantherous eucalypt group is indicated. Gauba & Pryor (1958) suggest that the combined group Renantherae and Renantherae-Normales might well be constituted a subgenus.

The comparative morphology, phylogeny and host associations of *Glycaspis* spp. in the subgenera *Synglycaspis* and *Glycaspis*, also suggest that the renantherous eucalypt species might be a more primitive group than those non-renantherous species known to be hosts of species in the subgenus *Glycaspis*.

It appears that a number of indications of host phylogenies, based on the *Glycaspis* spp. occurrences, at the specific level, are unsubstantiated by botanical evidence, but it should be remembered that a number of the hosts are of uncertain identification, and more detailed collections and identifications are necessary.

At the same time, the morphology of the male claspers and aedeagi of the two divergent *Synglycaspis* spp. forming round lerps on *E. acmenioides* (313) and *E. umbra* (311), suggest that their host plants constitute a divergent group of renantherous eucalypt species. This concept supports Hillis' view that the two "white mahogany" species should be kept separate from the "stringybarks". The divergent *Synglycaspis* spp. occurring on *E. coccifera* (418) and *E. linearis* (405) suggest divergence of the two host species.

The occurrence of a *Synglycaspis* species constructing flat lerps on *E. diversifolia* (297) suggests that this eucalypt is correctly placed in the renantherous species group by Blakely who indicated (p. 40) that *E. diversifolia* is very close to the Renantherae.

One anomalous result from some collections made, was that two species of the subgenus *Synglycaspis* (*G. tagmata* & *G. nigrocincta*), and one species of *Glycaspis* (*Glycaspis*), i.e. *G. eucalypti*, were obtained from *E. rodwayi* (215a). *G. tagmata* was bred by Mr. D. Martin, from material collected and identified by him; the host plant material of the *nigrocincta* and *eucalypti* collections was identified by Professor Jackson. It is possible that either some of the botanical material was incorrectly determined (probably on inadequate samples), or that species of *Synglycaspis* and *Glycaspis* both occur on the one host. Should the latter be the case, it would be the only known instance, so that more detailed investigations to resolve this point are indicated.

Carr & Carr (1962a in Leeper) suggested that the genus *Eucalyptus* (*sensu* Carr & Carr) should consist of Blakely's Series Eudesmieae and Miniatae; *E. jacksonii* (56); *E. preissiana* (246); *E. megacarpa* (247); *E. gamophylla* (288); Section Renantheroideae; Section Renantherae (except *E. guilfoylei* (305)); *E. microcorys* (314); and Series Myrtiformes. It is suggested from the *Glycaspis* spp. host associations determined during this project, that the inclusion of the species *E. tetrodonta* (7), *E. phoenicea* (13), *E. miniata* (14) and *E. gamophylla* (288) in their genus *Eucalyptus* may not be warranted, as psyllid species of the subgenus *Glycaspis* (*Glycaspis*) utilise these species as their hosts.

Series i (Eudesmieae), ii (Miniatae) & iii (Tetapterae).

Because of some doubt as to the correct placement of some of the species in these Series, they were intensively collected from, to determine if any *Glycaspis* spp. occurred on them, and if so, whether any indications as to the host plants' affinities with the remainder of the genus *Eucalyptus* could be correlated with the phylogeny of the *Glycaspis* spp. The following information was obtained:-

Eudesmieae.

E. ebbanoensis (5). A psyllid species constructing rectangular lerps, and of another genus of affinities with *Glycaspis*, occurred in large numbers on this host at Comet Vale, Western Australia, and several specimens were bred from the leaves. The construction of rectangular lerps by species in genera other than *Glycaspis*, previously had not been known. As rhinaria on this psyllid species occur on antennal segments 4 to 6, 8 and 9, the species is more primitive than any of the rectangular lerp-forming species of *Glycaspis*

occurring on certain non-renantherous species (see Table 1). The consistency of these lerps, from a visual assessment only, appeared similar to *Eucalyptolyma* spp. lerps found on *Angophora* and the eastern "bloodwood" and "spotted gum" groups of the Series Corymbosae-Peltatae, or to lerps of the round lerp-forming species of *Synglyscaspis* on renantherous species.

Blakely's concept of the species in his Series Eudesmieae, that "Members of this Series are closely allied to *Angophora*—" (p. 13), may be supported by the above observations on the lerps occurring on *E. ebbanoensis*, but not by the *Glycaspis* sp. on *E. tetradonta*.

E. tetradonta (7). Large numbers of *Glycaspis* (*Glycaspis*) *lucrosa* were obtained from this species, which suggests that *E. tetradonta* shows affinities with other non-renantherous eucalypts which also support populations of *Glycaspis* (*Glycaspis*) species (see Table 1). *Glycaspis lucrosa* is of close affinities with those species occurring on the eucalypts *phoenicea* (13), *miniata* (14), *brevifolia* (206), *gamophylla* (288), *alba* (207), *bigalerita* (209) and *houseana* (286).

Blake (1953) suggests that the Eudesmieae of Blakely should perhaps be limited to *erythrocoris* (1), *tetragona* (2), *eudesmioides* (3), *odontocarpa* (6) and perhaps *tetradonta* (7). Each of these species was sampled for *Glycaspis* spp. which were not obtained on any except *E. tetradonta*.

Gaub & Pryor (1959) found that *E. tetradonta* was the only species in the Eudesmieae without any suberisation in the chalaza region of the seeds. *Miniatae*.

E. phoenicea (13) and *E. miniata* (14). The occurrence of the one species *G. anota* on both of these species suggests that the hosts may have close affinities, and that they might be grouped with those non-renantherous eucalypt species supporting other *Glycaspis* (*Glycaspis*) species (see Table 1).

Gaub & Pryor (1961) found that the so-called "chalaza cork" of seeds of these two species is missing, as it is from *E. tetradonta* (7) also. The *Glycaspis* spp. associations suggest affinities of these three eucalypt species.

Chattaway (1955) records that both *E. phoenicea* and *E. miniata* undoubtedly display affinities with *E. gummiifera* (45) and other "bloodwoods". The *Glycaspis* associations do not support such affinities.

Tetrapterae.

E. tetraptera (15). The relatively primitive *G. felicitaris* utilises this species as host, thus indicating an affinity of its host with those non-renantherous species supporting *Glycaspis* (*Glycaspis*) species (see Table 1).

Series vi to xxii and xxxv to xlvii (non-renantherous species).

During the early stages of this project, some indications based on the phylogeny and host associations of the *Glycaspis* (*Glycaspis*) species constructing round lerps on host plants in these Series, appeared to suggest a possible evolutionary sequence of their *Eucalyptus* spp. hosts; e.g. from Table 1, it appears that: (i) the "box" group of species might be the more primitive representatives, and the *E. saligna* group of species the most recent species, in these Series; (ii) the association of the most primitive species *G. flavilabris* with *E. gonicalyx* (229) might suggest that its host is a primitive "box" species, as the sequential primitive and closely related *Glycaspis* spp. *egregia*, *cnecosis*, *suavis*, *buxalis* and *retrusa* all utilise species in the "box" group; (iii) the utilisation of *E. striatocalyx* (149) as host by *G. froggatti*, suggested that this host might be grouped with the "box" species which are also its hosts; (iv) at Nannine, Western Australia, both *G. froggatti* and *G. pervagata* occur on *E. striatocalyx* (149), after dispersing in different directions from the east, via a northern and a southern route respectively. *G. pervagata* appears to have essentially southern "mallee" associations, and *G. froggatti* essentially northern "box" associations, so that *E. striatocalyx* might be interpreted as showing some affinities with both the "mallee" and "box" groups. However, present knowledge concerning the phylogeny of the eucalypts does not necessarily support these indications.

At the same time, some *Glycaspis* spp. associations appear to support botanical interpretations of eucalypt affinities, such as: (i) the two closely related species *fasciculosa* (560) in South Australia and *polyanthemus* (558) in eastern New South Wales are both hosts of *Glycaspis* (*Glycaspis*) *whitei*;

(ii) *G. froggatti* occurs on *E. normantonensis* as well as on five other "box" species; (iii) *G. buxalis* and *G. froggatti* are both associated with *E. intertexta* (291) as well as with some "box" species, which appears to support the concept that *intertexta* is of close affinities with the "box" species; (iv) *G. anota* occurs on both *E. phoenicea* (13) and *E. miniata* (14) which supports evidence that these two eucalypts are of close affinities; (v) *G. wondjiniae* utilises *E. alba* (207), *E. bigalerita* (209) and *E. houseana* (286) as its hosts; (vi) *G. anomala* occurs on a number of "box" species; (vii) *G. onychis* utilises both *E. brevifolia* (206) and *E. gamophylla* (288) as its hosts; (viii) *G. johnsoni* utilises *E. blakelyi* (186), *E. dealbata* (189) and *E. dwyeri* (190) which are of close affinities, as its hosts; (ix) *G. brimblecombei* utilises *tereticornis* (178), *blakelyi* (186), *dealbata* (189), *camaldulensis* (197), *bridgesiana* (225) and possibly *nitens* (263) as hosts; (x) *G. australoraria* utilises *punctata* (78), *longifolia* (81), *tereticornis* (178) and *amplifolia* (184) as hosts; *G. pratensis* occurs on *tereticornis* (178) and *amplifolia* (184); (xi) similarities in the aedeagi of the *Glycaspis* spp. *brimblecombei*, *blakei*, *confinis*, *campbelli*, *imponens* and *baileyi* indicate their close affinities, and it is suggested that their hosts may also have affinities with each other, i.e. *camaldulensis* (197), *bridgesiana* (225), *tereticornis* (178), *blakelyi* (186), *dealbata* (189), *?nitens* (263), *propinqua* (75), the northern "gum" *Eucalyptus* sp., *rudis* (204), *cornuta* (96), *saligna* (60), *robusta* (67), *resinifera* (69) and *cypellocarpa* (262); (xii) the occurrence of *G. baileyi* on the eucalypts *saligna* (60), *resinifera* (69) and *robusta* (67) suggests close affinities of their hosts.

It thus becomes apparent that some *Glycaspis* spp. have evolved in close association with certain groups of eucalypt species, each of which may be regarded as being composed of species of some affinities.

The evolution of *Glycaspis* spp. no doubt proceeded under such significant environmental influences as altitude, latitude, and temperature and humidity regimes, typical of discrete localities.

Interpretations of some *Glycaspis/Eucalyptus* associations as possible indicators of the phylogeny of their individual hosts thus appear to be unreliable at the species level, although some appear to agree with botanical information concerning the eucalypt phylogeny.

Biogeographical influences during the evolution of the *Glycaspis* spp. *caurina*, *lucrosa*, *anota* and *wondjiniae*, as well as the *montana*, *baileyi*, *imponens* and *campbelli* group of species, are apparent, and adaptive radiation in each group could explain their similarities.

Physiological and chemical variability between or within the discrete host species are assumed to have considerably influenced the evolution of the various *Glycaspis* spp. through adaptive responses, as the following examples may indicate:-

(i) The occurrence of *G. wakelburae* (a species of close affinities with *G. froggatti*) on a "box" species at present known as *Eucalyptus* sp. under review, from 118 mi. N. Clermont to near Cooktown in Queensland, might indicate that this eucalypt is a biological entity distinct from those other "box" species which are hosts of *G. froggatti*.

(ii) The utilisation of *E. camaldulensis* as host by four discrete *Glycaspis* spp. appears to be of considerable interest. The widespread species *G. brimblecombei* was obtained on *E. camaldulensis* from Adelaide, South Australia, to 107 mi. N. Clermont, Queensland (see Map 3). At the latter collecting site it occurred on a host (a "gum" identified as *Eucalyptus* sp.) together with *G. blakei*, a species of close affinities. From that collecting site, across the north of the continent and thence south to 11 mi. S. Meekatharra, Western Australia, no *brimblecombei* specimens were obtained, but the species *G. blakei* was consistently collected from hosts which always appeared to be this "gum" species. The host plant material collected at the latter site was identified by C. A. Gardner as *E. camaldulensis* (197). The "gum" *Eucalyptus* sp. on which *G. blakei* occurs, appears to be included with *E. camaldulensis* and its five varieties by Blakely.

From near Perth to Cape Leeuwin, Western Australia, *G. confinis*, another species of close affinities with *G. blakei* and *G. brimblecombei*, occurred on *E. rudis* (204) and *E. cornuta* (96).

(iii) Similarly, the discrete species *G. eremica* and *G. gradata* occur on *E. camaldulensis* growing in the far north-west of N.S.W., and from near Hay, N.S.W., to Bendigo, Victoria, respectively, so that further biological divergence from the *E. camaldulensis* which is the host of *G. brimblecombei* is again suggested for the hosts in those approximate areas*.

The *Glycaspis* spp. associations suggest some physiological and/or chemical divergence among groups of *E. camaldulensis* occurring in the discrete areas which might be delimited by the distribution of each of these four *Glycaspis* spp. On examination of the distribution of Blakely's varieties of *E. camaldulensis* it is suggested that *G. brimblecombei* is associated with the variety *camaldulensis* only, of Blakely.

Banks & Hillis (1969) have recently examined the polyphenols in samples of *E. camaldulensis* collected throughout its natural habitat. Samples were grouped by computer analysis and a "mature leaf" dendrogram was constructed from the crude data. There were two major groupings, A to H and I to T, based on certain polyphenols in the leaves.

It is of considerable interest that, in the group A to H, only four localities (i.e. Ng, approximately Bogan River, N.S.W.; Sc, south of Lake Eyre, South Australia; Qo, near Injune, Queensland, and Nh, near Wilcannia, N.S.W.) out of about 35 localities given, do not appear to coincide with the known distribution of *G. blakei* which utilises the "gum" *Eucalyptus* sp. as host. This occurrence of *G. blakei* on the "*camaldulensis*" in the general area of the group A to H localities, appears to indicate that there may be some biologically variable factors in the host species, to which evolutionary influences in *Glycaspis* have responded sufficiently to allow adaptation of, firstly, the species *G. blakei*, then in other discrete localities within the overall distribution of *camaldulensis*, adaptations of the species *brimblecombei*, *eremica* and *gradata*.

Pryor & Byrne (1969) studied the pattern of variation in *E. camaldulensis* from sites between the approximate latitudes 14°S. in the Northern Territory, to 35°S. in South Australia, and principally between meridians 130°E. and 140°E. They found that there was an apparent discontinuity about latitude 27°S., and suggested that the total population of *E. camaldulensis* would be better regarded as forming two rather closely related taxa, as northern and southern populations respectively, but that this interpretation would be dependent on further studies of the zone of apparent discontinuity.

From the collections of *Glycaspis* spp. during this project, it has been found that the most southern distribution of *G. blakei*, and presumably of its particular host, a "gum" *Eucalyptus* sp., corresponds favourably in Western Australia with the interpretation of Pryor & Byrne (i.e. to about latitude 27°S.). In Queensland, the same insect/host association did not correspond so favourably, in that the most northern distribution of *G. brimblecombei* and the most southern of *G. blakei*, coincided on the same host at a locality 107 mi. N. Clermont (Belyando River bridge, on the Charters Towers road) slightly south of latitude 21°S*.

Further intensive collecting in areas to the west of the project route might well extend further to the south the distribution limits for *G. blakei*, but the overlapping distribution limits for *G. blakei* and *G. brimblecombei* on the same plant, appears significant for the areas traversed during this project.

Glycaspis spp. became associated with certain eastern "gum" eucalypt species (*tereticornis* (178), *camaldulensis* (197) etc.) at a relatively late stage of evolutionary development within *Glycaspis* (see Table 1) but the interpretation that this suggests a more recent evolution of those "gum" species which are their hosts, is not necessarily substantiated on present information concerning the insect/host interactions.

With the knowledge of the *Glycaspis* spp./Host associations presented here as a basis, a considerable field of investigations along these same lines remains, both in substantiating this work and providing further information on those species concerning which little is known.

* See postscript, p. 373.

AUSTRALIAN CONTINENTAL DRIFT

Of recent years, biological evidence for the supposed drift in the relative positions of the large land masses of the world during the geological time-scale is accumulating.

The botanical aspects of evidence in support of such land movements are strikingly presented by Good (1964). Of particular interest is the theoretical drift of Australia to its present position, and the conclusion that, from the botanical aspect, New Guinea and Australia cannot have been in their present relative positions for any considerable length of time in geological terms, and that their present contiguity is now as close as, or closer than, it has been in the past. With Australia in its present position, there is apparently a profound line of botanical demarcation between this continent and New Guinea, so that Australia and its flora appear to have become intruded into a more orderly picture.

Some entomological information supporting the evidence for continental drift is given by Britton (1953), and the distributions of the hemipterous Peloridiidae and the dipterous Blepharoceridae are discussed. According to Heslop-Harrison (1956) the larval forms of Psyllidae in many cases approximate those of the Peloridiidae and the external male genitalia have many points in common with that of the latter.

Gressitt (1959) reports that in general, his study of the Cerambycidae confirms his view that New Guinea is part of the Oriental Region as far as insects are concerned, and that the precinctive genera, being of Oriental relationship, indicate that the Australian elements were recently superimposed on an Oriental fauna.

Duffy (1968) has included the Territory of Papua & New Guinea with the Oriental Region, because of faunistic relationships.

From present knowledge concerning the origin and dispersal of *Glycaspis* spp., there appears to be an analogy with these previous interpretations, in that the most primitive subgenus (*Synglycaspis*) is concentrated in the southern and south-eastern areas of the continent; the intermediate subgenus (*Glycaspis*) is distributed throughout the continent, with three female specimens only, recorded from New Guinea; four species of the most recent subgenus (*Boreioglycaspis*) occur from Penang Island to the southern Philippine Islands, which suggests that the subgenus spread northwards on *Melaleuca* spp. from its apparently southern limits on the Central Coast of N.S.W., across the north of the continent, and beyond Australia to the Philippine Islands.

On present information, it thus appears that a possible route of dispersal of the subgenus *Boreioglycaspis* from Australia was by way of the north-west of the continent, rather than through Cape York to New Guinea and thence westward through the Indonesian Islands. This hypothetical interpretation is dependent on future information from extensive collections for *Glycaspis* spp. throughout New Guinea and the islands to the west and the north; but of recent years, intensive collecting by the B.P. Bishop Museum Field Station staff at Wau, New Guinea, and requests for specimens from the Agricultural and Forests organisations of New Guinea, have given no indication of the occurrence of the subgenus *Boreioglycaspis* on that island.

Some entomological evidence for the supposed drift of Australia towards New Guinea rather than away from it, thus appears to be consistent with the botanical interpretation presented by Good.

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TABLES

Table 1. *Glycaspis* (*Glycaspis*) spp./Host/Distribution, in the sequence of insect taxonomy. Known lerp shape given in parentheses

(R) = round
(O) = oval
(RT) = rectangular

Table 2. Species/Host Associations, genus *Glycaspis* (alphabetical).

[S] = *Synglycaspis* (G) = gall
[G] = *Glycaspis* (F) = flat lerp
[B] = *Boreioglycaspis* (R) = round lerp
(O) = oval lerp
(RT) = rectangular lerp

Table 3. Host/Species Associations, genus *Glycaspis* (alphabetical).

TABLE 1

Species	Hosts	Distribution
<i>flavilabris</i> (R)	<i>goniocalyx</i>	Rylstone-Canberra (NSW)
<i>eucalypti</i> (R)	<i>viminalis</i> <i>rodwayi</i> ? <i>ovata</i> ? <i>dalrympleana</i>	Kiandra-Hobart (NSW-Tas)
<i>minuscula</i> (R)	<i>cinerea</i> <i>rubida</i> <i>cephalocarpa</i> ? <i>viminalis</i>	Goulburn-Melbourne (NSW-V)
<i>egregia</i> (R)	<i>moluccana</i>	Brisbane-Calliope (Q)
<i>cnecosis</i> (R)	<i>cabbageana</i>	Banana (Q)
<i>suavis</i> (R)	<i>populnea</i> <i>Euc. sp.</i> (box)	Clermont-Hillston (Q-NSW)
<i>buxalis</i> ?(R)	<i>microtheca</i> ? <i>intertexta</i> ? <i>melanophloia</i>	E. Qld.-Pt. Hedland (Q-WA)
<i>retrusa</i> ?(R)	<i>largiflorens</i> <i>leptophleba</i> <i>microtheca</i> <i>tectifica</i>	Hillston-Vic. Riv. X-ing (NSW-NT)
<i>pervagata</i> (R)	<i>dumosa</i> <i>gracilis</i> <i>incrassata</i> <i>pileata</i> <i>brachycalyx</i> <i>torquata</i> <i>striatocalyx</i> <i>lesouefii</i> ? <i>calycogona</i> ? <i>salmonophloia</i> ? <i>dongarraensis</i> ? <i>griffithsii</i> ? <i>foecunda</i> <i>oleosa</i> <i>porosa</i> ? <i>foecunda</i> ? <i>leucoxylon</i> ? <i>melanophloia</i>	Goolgowie-Geraldton (NSW-WA)
<i>repetina</i> (R)		(SA)
<i>collina</i>		Gayndah-Rockhampton (Q)
<i>brunneincincta</i> (R)	? <i>major</i> ? <i>propinqua</i> ? <i>tessellaris</i>	Plunkett-Callide (Q)
<i>dobsoni</i> (?R-O)	<i>viminalis</i>	Hobart-Cygnets (T)
<i>hadlingtoni</i>	<i>intertexta</i> ? <i>largiflorens</i>	Cobar-Willandra Crk. (NSW)
<i>rylstonensis</i>	<i>blakelyi</i>	Rylstone (NSW)
<i>grapta</i> (?R-O)	<i>oleosa</i> ? <i>salmonophloia</i>	Cobar-Geraldton (NSW-WA)
<i>wanbiensis</i> (R)	<i>oleosa</i> ? <i>foecunda</i> ? <i>leucoxylon</i>	(SA)
<i>notialis</i> (R)	<i>gracilis</i> <i>pileata-dumosa</i> ? <i>oleosa</i> ? <i>porosa</i>	Bow Hill-Norseman (SA-WA)
<i>occidentalis</i> (R)	<i>gomphocephala</i> <i>redunca</i> ? <i>oleosa</i> ? <i>calycogona</i>	Perth-Kalgoorlie (WA)
<i>yilgarniensis</i>	<i>gamophylla</i> ? <i>lesouefii</i>	Mundiwindi-Menzies (WA)
<i>infucata</i> (R)	<i>leptopoda</i>	Geraldton (WA)
<i>felicitaris</i> (R)	<i>tetraptera</i>	Esperance (WA)
<i>subita</i>	<i>cornuta</i>	Stirling Ra. (WA)
<i>rivalis</i> (R)	<i>paniculata</i> ? <i>ovata</i>	Lisarow-Lakes Entrance (NSW-Vic)
<i>pilata</i> (R)	<i>paniculata</i>	Kurrajong (NSW)
<i>whitei</i> (R)	<i>fasciculosa</i> <i>polyanthemos</i>	Rylstone-Adelaide (NSW-SA)
<i>fuscovena</i> (?R-O)	<i>odorata</i> ? <i>fasciculosa</i> ? <i>woollsiana</i> ? <i>microcarpa</i> ? <i>leucoxylon</i>	Narrandera-Adelaide (NSW-SA)
<i>wagaitjae</i> (R)	? <i>tetradonta</i>	Darwin (NT)
<i>caurina</i> (R)	<i>jensenii</i>	Timber Crk (NT)
<i>lucrosa</i> (R)	<i>tetradonta</i>	Normanton-Darwin (Q-NT)

Species		Hosts	Distribution
<i>anota</i>	(R)	<i>phoenicea miniata</i>	Georgetown-Derby (Q-WA)
<i>wondjinae</i>	(R)	<i>houseana alba bigalerita</i>	Townsville-Kimberleys (Q-WA)
<i>quornensis</i>		<i>albens microcarpa ?leucoxylon</i>	Quorn-Omeo ?Merriwa (SA-NSW)
<i>anomala</i>	?(R)	<i>microtheca largiflorens cambageana thozetiana ?populnea ?woollsiana ?microcarpa</i>	Deniliquin-Clermont (NSW-Q)
<i>johnsoni violae</i>		<i>blakelyi dwyeri dealbata ?largiflorens ?melanophloia</i>	A.C.T.-Narrabri (NSW) 131 N. Clermont (Q)
<i>onychis</i>	(R)	<i>brevifolia gamophylla</i>	Mt. Isa-Hamersley Ra. (Q-WA)
<i>lactea</i>	(R)	<i>?blakelyi ?dealbata</i>	Strahorn SF (Dubbo) (NSW)
<i>hackeri</i>		<i>?</i>	Brisbane (Q)
<i>rubritincta</i>	(R)	<i>confluens</i>	Kimberleys (WA)
<i>exsertae</i>		<i>exserta</i>	Clermont (Q)
<i>froggatti</i>	(R-RT)	<i>argillacea oligantha striatocalyx tectifica normantonensis microtheca microneura leptophleba ?intertexta</i>	Normanton-Nannine (Q-WA)
<i>blakei</i>	?(R)	<i>Euc. sp. (gum)</i>	107 N. Clermont-Meekatharra (Q-WA)
<i>eremica</i>	?(R)	<i>?camaldulensis</i>	Quorn-Milparinka (SA-NSW)
<i>taylori</i>	(R)	<i>globulus ovata</i>	Hobart-Mt. Victoria (T-NSW)
<i>gradata</i>	?(R)	<i>?camaldulensis ?largiflorens</i>	Bendigo-Willandra Crk. (V-NSW)
<i>confinis</i>	(R)	<i>rudis ?cornuta</i>	Perth - C. Naturaliste (WA)
<i>wakelburae</i>	(R-O)	<i>thozetiana microtheca Euc. sp. (box)</i>	Emerald-Cooktown (Q)
<i>brimblecombei</i>	(R)	<i>camaldulensis dealbata tereticornis blakelyi bridgesiana ?nitens Euc. sp. (gum)</i>	Adelaide-Clermont (SA-Q)
<i>mannifera</i>	(R)	<i>moluccana ?polyanthemos</i>	Prospect-Tumut (NSW)
<i>xanthopepla</i>	(R)	<i>seeana</i>	Plunkett (Q)
<i>pratensis</i>	(R)	<i>tereticornis amplifolia</i>	Prospect-Rockhampton (NSW-Q)
<i>australoraria</i>	(R)	<i>tereticornis amplifolia longifolia punctata</i>	Adelaide-Brisbane (SA-Q)
<i>struicis</i>	(R)	<i>tereticornis</i>	Merrylands (NSW)
<i>montana</i>	(R)	<i>dunnii</i>	Clouds Crk. (Grafton) (NSW)
<i>baileyi</i>	(R)	<i>saligna robusta resinifera</i>	Lisarow-Clouds Crk. (NSW)
<i>imponens</i>	(R)	<i>propinqua</i>	Kincumber (NSW)
<i>campbelli</i>	?(R)	<i>cypellocarpa ?ovata ?cephalocarpa</i>	Eden-Montrose (NSW-Vic)
<i>locaridensis</i>	(O)	<i>populnea ?blakelyi ?melliadora</i>	Parkes-Dubbo-Clermont (NSW-Q)
<i>amnicola</i>	(O)	<i>camaldulensis polyanthemos ?oleosa ?tereticornis</i>	Quorn-Moree (SA-NSW)
<i>prepta</i>	(O)	<i>blakelyi melliadora ?tereticornis ?longifolia ?camaldulensis ?oleosa ?intertexta</i>	Corryong-Prospect (V-NSW)
<i>wiradjurae</i>		<i>paniculata</i>	Hillston (NSW)
<i>permista</i>	(O)	<i>leucoxylon odorata porosa</i>	Sydney-Wamberal (NSW)
<i>schwarzi</i>	(O)	<i>leucoxylon</i>	(SA)
<i>sudicola</i>	(O)	<i>sideroxylon</i>	Deniliquin-Springsure (NSW-Q)

Species		Hosts	Distribution
<i>igneae</i>	(O)	<i>deaneae</i> ? <i>longifolia punctata</i>	Wyong-Eden (NSW)
<i>kurrajongensis</i>	(O)	<i>paniculata</i>	Kurrajong (NSW)
<i>mellialata</i>	(O)	<i>paniculata</i>	Wyong (NSW)
<i>neureta</i>	(O)	<i>melliodora</i>	Breeza-You Yangs (NSW-V)
<i>oraria</i>	(O)	<i>robusta</i> X <i>resinifera</i>	Mona Vale (NSW)
<i>amydra</i>	(O)	<i>goniocalyx bridgesiana largiflorens</i>	Rylstone-Canberra (NSW)
<i>monita</i>		<i>mannifera</i> ss. ? <i>melliodora</i>	Keith (SA)
<i>lacustris</i>	(O)	<i>fasciculosa</i>	Lakes Entrance (V)
<i>mesicola</i>		<i>ovata</i>	Goodna-Carnarvon Ra. (Q)
		<i>?drepanophylla</i>	
<i>deirada</i>	(RT)	<i>dundasii</i>	Fraser Ra. (WA)
<i>deirada</i> group complex	(RT)	<i>loxophleba gracilis foecunda redunca</i>	Eba-Perth (SA-WA)
		<i>intertexta gomphocephala campaspe</i>	
		<i>cylindriflora cornuta annulata calycogona</i>	
		<i>salmonophloia salubris platypus</i>	
		<i>diversicolor ?rudis ?oleosa ?occidentalis</i>	
		<i>?comitae-vallis ?lesouefii</i>	
<i>aurosala</i>	(RT)	<i>thozetiana</i>	Clermont-Charleville (Q)
<i>emphanes</i>	(RT)	<i>cambageana</i>	Emerald-Clermont (Q)
<i>siliciflava</i>	(RT)	<i>robusta</i>	Wamberal (NSW)
<i>granulata</i>	(RT)	<i>saligna grandis botryoides ?robusta</i>	Sussex Inlet-Mt. Spec (NSW-Q)

TABLE 2

Species		Host
[B] <i>abudicola</i>		<i>Melaleuca nervosa</i>
[S] <i>aggregata</i>	(R)	<i>Euc. haemastoma</i>
[G] <i>amnicola</i>	(O)	<i>camaldulensis polyanthemos ?tereticornis ?oleosa</i>
[S] <i>amplificata</i>	(G)	<i>acmenoides</i>
[G] <i>amydra</i>	(O)	<i>bridgesiana goniocalyx ?melliodora largiflorens mannifera</i> ss.
[G] <i>anomala</i>	? (R)	<i>microtheca largiflorens cambageana thozetiana ?populnea</i>
		<i>?woollstiana ?microcarpa</i>
[G] <i>anota</i>	(R)	<i>phoenicea miniata</i>
[G] <i>aurosala</i>	(RT)	<i>thozetiana</i>
[G] <i>australiensis</i>		<i>Tristania conferta</i>
[G] <i>australoraria</i>	(R)	<i>Eucalyptus longifolia amplifolia tereticornis punctata</i>
[G] <i>baileyi</i>	(R)	<i>Eucalyptus saligna robusta resinifera</i>
[S] <i>belua</i>	(G)	<i>niphophila</i>
[G] <i>blakei</i>	(?R)	<i>Eucalyptus</i> sp. (gum)
[B] <i>borneensis</i>	?	?
[G] <i>brimblecombei</i>	(R)	<i>Eucalyptus dealbata camaldulensis ?nitens tereticornis blakelyi</i>
		<i>bridgesiana Euc. sp. (gum)</i>
[G] <i>brunneincincta</i>	(R)	<i>?major ?propinqua ?tessellaris</i>
[S] <i>brunosa</i>	(G)	<i>coccifera</i>
[G] <i>buxalis</i>	(?R)	<i>microtheca ?melanophloia ?intertexta</i>
[G] <i>campbelli</i>	(?R)	<i>Euc. cypellocarpa ?ovata ?cephalocarpa</i>
[G] <i>caurina</i>	(R)	<i>jensenii</i>
[S] <i>cellula</i>	(G)	<i>?amygdalina</i>
[G] <i>cnecosis</i>	(R)	<i>cambageana</i>
[G] <i>collina</i>	?	<i>?melanophloia</i>
[S] <i>commoni</i>	(G)	?
[G] <i>confinis</i>	(R)	<i>rudis ?cornuta</i>
[S] <i>conflecta</i>	(R)	<i>eugenoides ?oblonga ?macrorhyncha ?agglomerata</i>
[S] <i>conserta</i>	(R)	<i>sieberi</i>
[S] <i>cyanoreia</i>	(R)	<i>stricta</i>
[S] <i>cyrtona</i>	(G)	<i>piperita</i>

Species		Host
[S] <i>cyta</i>	(G)	<i>pilularis</i>
[G] <i>deirada</i>	(RT)	<i>dundasii</i>
[G] <i>deirada</i> complex		<i>loxophleba</i> ? <i>rudis</i> <i>gracilis</i> <i>foecunda</i> <i>intertexta</i> <i>gomphocephala</i> <i>campaspe</i> ? <i>occidentalis</i> <i>cylindriflora</i> <i>cornuta</i> <i>annulata</i> ? <i>oleosa</i> <i>calycogona</i> ? <i>comitae-vallis</i> <i>salmonophloia</i> <i>salubris</i> <i>redunca</i> ? <i>lesouefii</i> <i>platypus</i> <i>diversicolor</i>
[B] <i>denigrata</i>		<i>Melaleuca acacioides</i>
[B] <i>devexa</i>		<i>leucadendron cajuputi</i>
[B] <i>devicola</i>		<i>viridiflora</i>
[G] <i>dobsoni</i>	(R-O)	<i>Eucalyptus viminalis</i>
[S] <i>dreptodria</i>	(R)	<i>simmondsii</i> ? <i>amygdalina</i> ? <i>radiata</i> ? <i>stellulata</i>
[G] <i>egregia</i>	(R)	<i>moluccana</i>
[G] <i>emphanes</i>	(RT)	<i>cambageana</i>
[S] <i>encystis</i>	(G)	<i>agglomerata</i>
[S] <i>endasa</i>	(R)	<i>robertsonii</i>
[G] <i>eremica</i>	(?R)	? <i>camaldulensis</i>
[G] <i>eucalypti</i>	(R)	<i>viminalis</i> <i>rodwayi</i> ? <i>dalrympleana</i> ? <i>ovata</i> ? <i>obliqua</i>
[G] <i>exsertae</i>	?	<i>exserta</i>
[G] <i>felicitaris</i>	(R)	<i>tetraptera</i>
[G] <i>flavilabris</i>	(R)	<i>goniocalyx</i>
[B] <i>forcipata</i>	?	?
[G] <i>froggatti</i>	(R-RT)	<i>argillacea</i> <i>oligantha</i> <i>tectifica</i> <i>striatocalyx</i> ? <i>intertexta</i> <i>normantonensis</i> <i>microtheca</i> <i>mirconeura</i> <i>leptophleba</i>
[S] <i>fuliginis</i>	(R)	<i>globoidea</i> ? <i>andreae</i>
[G] <i>fuscovena</i>	(?R-O)	<i>odorata</i> ? <i>fasciculosa</i> ? <i>woollsi</i> ? <i>microcarpa</i> ? <i>leucoxydon</i>
[G] <i>gradata</i>	(?R)	<i>Eucalyptus</i> ? <i>camaldulensis</i> ? <i>largiflorens</i>
[G] <i>granulata</i>	(RT)	<i>saligna</i> <i>grandis</i> <i>botryoides</i> ? <i>robusta</i>
[G] <i>grapta</i>	(?R-O)	<i>oleosa</i> ? <i>salmonophloia</i>
[G] <i>hackeri</i>	?	?
[G] <i>hadlingtoni</i>	?	<i>intertexta</i> ? <i>largiflorens</i>
[S] <i>hirsuta</i>	(R)	<i>pilularis</i> ? <i>cypellocarpa</i>
[S] <i>icterica</i>	(R)	<i>marginata</i> ? <i>jacksonii</i>
[G] <i>igneae</i>	(O)	<i>deanei</i> ? <i>longifolia</i> <i>punctata</i>
[S] <i>immaceria</i>	(G)	<i>rossii</i>
[G] <i>imponens</i>	(R)	<i>propinqua</i>
[S] <i>inclusa</i>	(G)	<i>umbra</i>
[G] <i>infucata</i>	(R)	<i>leptopoda</i>
[G] <i>johnsoni</i>	?	<i>blakelyi</i> <i>dwyeri</i> <i>dealbata</i> ? <i>largiflorens</i>
[G] <i>kurrajongensis</i>	(O)	<i>paniculata</i>
[G] <i>lactea</i>	(R)	? <i>blakelyi</i> ? <i>dealbata</i>
[G] <i>lacustris</i>	(O)	<i>ovata</i>
[G] <i>locaridensis</i>	(O)	<i>populnea</i> ? <i>blakelyi</i> ? <i>melliodora</i>
[S] <i>longaeva</i>	(G)	<i>linearis</i>
[G] <i>lucrosa</i>	(R)	<i>tetrodonta</i>
[S] <i>mactans</i>	(R)	<i>acenioides</i>
[G] <i>mannifera</i>	(R)	<i>moluccana</i> ? <i>polyanthemos</i>
[B] <i>melaleuca</i>		<i>Melaleuca quinquenervia</i> <i>argentea</i> <i>leucadendron</i> <i>nervosa</i>
[G] <i>mellialata</i>	(O)	<i>Eucalyptus paniculata</i>
[G] <i>mesicola</i>	?	? <i>drepanophylla</i>
[G] <i>minuscule</i>	(R)	<i>cinerea</i> <i>cephalocarpa</i> <i>rubida</i> ? <i>viminalis</i>
[G] <i>monita</i>	?	<i>fasciculosa</i>
[G] <i>montana</i>	(R)	<i>dunnii</i>
[B] <i>muminae</i>		<i>Melaleuca viridiflora</i>
[S] <i>munita</i>	(G)	<i>Eucalyptus simmondsii</i>
[G] <i>neureta</i>	(O)	<i>melliodora</i>
[S] <i>nigrocincta</i>	(R)	<i>coccifera</i> <i>rodwayi</i> <i>delegatensis</i>
[G] <i>notialis</i>	(R)	<i>gracilis</i> ? <i>oleosa</i> ? <i>porosa</i> <i>pileata-dumosa</i> complex
[S] <i>nundlensis</i>	(F)	<i>radiata</i> <i>subplatyphylla</i>
[S] <i>obvelata</i>	(G)	? <i>sieberi</i>
[G] <i>occidentalis</i>	(R)	<i>gomphocephala</i> ? <i>oleosa</i> ? <i>calycogona</i> <i>redunca</i>

Species		Host
[S] <i>occulta</i>	(G)	?simmondsii
[G] <i>onychis</i>	(R)	brevifolia gamophylla
[G] <i>oraria</i>	(O)	robusta X resinifera
[S] <i>orientalis</i>	(R)	umbra
[B] <i>paludis</i>		Melaleuca quinquenervia
[S] <i>particeps</i>	(R)	Eucalyptus obliqua baxteri ?oblonga ?macrorhyncha ?caliginosa
[B] <i>penangensis</i>	?	?
[G] <i>permista</i>	(O)	Eucalyptus paniculata
[S] <i>perthecata</i>	(G)	haemastoma
[G] <i>pervagata</i>	(R)	dumosa gracilis pileata incrassata brachycalyx torquata striaticalyx ?calycogona ?salmonophloia ?dongarraensis lesouefii ?griffithsii ?foecunda
[S] <i>phreata</i>	(F)	oblonga
[G] <i>pilata</i>	(R)	paniculata
[S] <i>planaria</i>	(F)	piperita
[S] <i>planitecta</i>	(F)	oblonga caliginosa diversifolia baxteri robertsonii simmondsii niphophila stellulata pauciflora ?amygdalina obliqua coccifera rossii macrorhyncha dives
[B] <i>polymelasma</i>	?	?
[G] <i>pratensis</i>	(R)	tereticornis amplifolia
[G] <i>prepta</i>	(O)	blakelyi melliadora ?tereticornis ?longifolia ?camaldulensis
[G] <i>quornensis</i>	?	albans microcarpa ?leucoxylon
[G] <i>repentina</i>	(R)	oleosa porosa ?foecunda ?leucoxylon
[G] <i>retrusa</i>	(?R)	largiflorens leptophleba ?tectifica microtheca
[G] <i>rivalis</i>	(R)	paniculata ?ovata
[G] <i>rubritincta</i>	(R)	confluens
[G] <i>rylstonensis</i>	?	blakelyi
[S] <i>salebrosa</i>	(R)	piperita andrewsii
[G] <i>schwarzi</i>	(O)	leucoxylon odorata porosa
[S] <i>seriata</i>	(R)	pilularis
[G] <i>siliciflava</i>	(RT)	robusta
[G] <i>struicis</i>	(R)	tereticornis
[G] <i>suavis</i>	(R)	populnea Euc. sp.
[G] <i>subita</i>	?	cornuta
[G] <i>sudicola</i>	(O)	sideroxylon
[S] <i>tagmata</i>	(F)	roadwayi
[G] <i>taylori</i>	(R)	globulus ovata
[S] <i>temenicola</i>	(R)	linearis simmondsii ?pauciflora
[G] <i>violae</i>	?	?melanophloia
[G] <i>wagaitjae</i>	(R)	?tetrodonta
[G] <i>wakelburae</i>	(R-O)	thozetiana microtheca Euc. sp.
[G] <i>wanbiensis</i>	(R)	oleosa ?leucoxylon ?foecunda
[G] <i>whitei</i>	(R)	fasciculosa polyanthemom
[G] <i>wiradjurae</i>	?	?oleosa ?intertexta
[G] <i>wondjinae</i>	(R)	houseana alba bigalerita
[G] <i>xanthopepla</i>	(R)	seeana
[G] <i>yilgarniensis</i>	?	gamophylla ?lesouefii

POSTSCRIPT

The suggestion of biological divergence in *E. camaldulensis* in the far north-west of N.S.W. (p. 365) was confirmed by the presence of *G. eremica* and the absence of *G. brimblecombei* from numerous collections by the writer west of White Cliffs, during May, 1970.

G. blakei was obtained in association with *G. brimblecombei* from *E. camaldulensis* at Gongolgon (Bogan Riv.) and Wilcannia (Darling Riv.). This suggests that some specimens of the host in these two localities show affinities with both the northern taxon (indicated by *G. blakei*) and the southern taxon (indicated by *G. brimblecombei*), and agrees with the findings of Banks & Hillis (1969) for their samples Ng3 & Nh2 in Group A to H (northern taxon) and samples Ng1, Ng2 & Nh1 in Group I to T (southern taxon).

TABLE 3

Host	Species
<i>Euc. acmenioides</i>	<i>amplificata mactans</i>
<i>agglomerata</i>	<i>encystis ?conflecta</i>
<i>alba</i>	<i>wondjinae</i>
<i>albens</i>	<i>quornensis</i>
<i>amplifolia</i>	<i>pratensis australoraria</i>
<i>?amygdalina</i>	<i>dreptodria cellula planitecta</i>
<i>?andreana</i>	<i>fuliginis</i>
<i>andrewsii</i>	<i>salebrosa</i>
<i>annulata</i>	<i>deirada complex</i>
<i>argillacea</i>	<i>froggatti</i>
<i>baxteri</i>	<i>planitesta particeps</i>
<i>bigalerita</i>	<i>wondjinae</i>
<i>blakelyi</i>	<i>brimblecombei prepta rylstonensis johnsoni</i>
<i>?</i>	<i>lactea locaridensis</i>
<i>?bosistoana</i>	<i>mannifera</i>
<i>botryoides</i>	<i>granulata</i>
<i>brachycalyx</i>	<i>pervagata</i>
<i>brevifolia</i>	<i>onychis</i>
<i>bridgesiana</i>	<i>amydra brimblecombei</i>
<i>caliginosa</i>	<i>planitecta ?particeps</i>
<i>calycogona</i>	<i>deirada complex</i>
<i>?</i>	<i>pervagata ?occidentalis</i>
<i>camaldulensis</i>	<i>brimblecombei amnicola</i>
<i>?</i>	<i>blakei eremica prepta gradata occidentalis</i>
<i>cambageana</i>	<i>anomala cnecosia emphanes</i>
<i>?</i>	<i>brunneincincta</i>
<i>campaspe</i>	<i>deirada complex (round lerps)</i>
<i>cephalocarpa</i>	<i>minuscule</i>
<i>?</i>	<i>campbelli minuscule</i>
<i>?</i>	<i>minuscule</i>
<i>cinerea</i>	<i>brunosa nigrocineta planitecta</i>
<i>coccifera</i>	<i>deirada complex</i>
<i>?comitae-vallis</i>	<i>rubritincta</i>
<i>confluens</i>	<i>subita deirada complex</i>
<i>cornuta</i>	<i>confinis</i>
<i>?</i>	<i>deirada complex (round lerps)</i>
<i>cylindriflora</i>	<i>campbelli</i>
<i>cypellocarpa</i>	<i>hirsuta</i>
<i>?</i>	<i>eucalypti</i>
<i>?dalrympleana</i>	<i>johnsoni brimblecombei</i>
<i>dealbata</i>	<i>lactea</i>
<i>?</i>	<i>ignea</i>
<i>deanei</i>	<i>nigrocineta</i>
<i>delegatensis</i>	<i>deirada complex</i>
<i>diversicolor</i>	<i>planitecta</i>
<i>diversifolia</i>	<i>planitecta</i>
<i>dives</i>	<i>pervagata</i>
<i>?dongarraensis</i>	<i>mesicola</i>
<i>?drepanophylla</i>	<i>pervagata</i>
<i>dumosa</i>	<i>pervagata notialis deirada complex</i>
<i>dumosa-pileata</i>	<i>deirada</i>
<i>dundasii</i>	<i>montana</i>
<i>dunnii</i>	<i>johnsoni</i>
<i>dwyeri</i>	<i>wakelburae suavis</i>
<i>Euc. sp. (box)</i>	<i>blakei brimblecombei</i>
<i>Euc. sp. (gum)</i>	<i>conflecta</i>
<i>Euc. eugenioides</i>	<i>exsertae</i>
<i>exserta</i>	<i>whitei monita</i>
<i>fasciculosa</i>	<i>fuscovena</i>
<i>?</i>	

Host	Species
<i>foecunda</i>	<i>deirada</i> complex
?	<i>wanbiensis</i> <i>repentina</i> <i>pervagata</i>
<i>gamophylla</i>	<i>ylgarniensis</i> <i>onychis</i>
<i>globoidea</i>	<i>fuliginis</i>
<i>globulus</i>	<i>taylori</i>
<i>gomphocephala</i>	<i>occidentalis</i> <i>deirada</i> complex
<i>goniocalyx</i>	<i>flavilabris</i> <i>amydra</i>
<i>gracilis</i>	<i>notialis</i> <i>pervagata</i> <i>deirada</i> complex
<i>grandis</i>	<i>granulata</i>
<i>?griffithsii</i>	<i>pervagata</i>
<i>haemastoma</i>	<i>perthecata</i> <i>aggregata</i>
<i>houseana</i>	<i>wondjiniae</i>
<i>incrassata</i>	<i>pervagata</i>
<i>intertexta</i>	<i>hadlingtoni</i>
?	<i>froggatti</i> <i>buxalis</i> <i>retrusa</i> <i>wiradjurae</i> <i>deirada</i> complex
<i>?jacksonii</i>	<i>icterica</i>
<i>jensenii</i>	<i>caurina</i>
<i>largiflorens</i>	<i>anomala</i> <i>retrusa</i>
?	<i>hadlingtoni</i> <i>johnsoni</i> <i>?gradata</i>
<i>leptophleba</i>	<i>froggatti</i> <i>retrusa</i>
<i>leptopoda</i>	<i>infucata</i>
<i>lesouefii</i>	<i>pervagata</i> <i>deirada</i> complex
?	<i>ylgarniensis</i>
<i>leucoxylon</i>	<i>schwarzi</i>
?	<i>quornensis</i> <i>repentina</i> <i>wanbiensis</i> <i>fuscovena</i>
<i>linearis</i>	<i>longaeva</i> <i>temenicola</i>
<i>longifolia</i>	<i>australoraria</i>
?	<i>prepta</i> <i>ignea</i>
<i>loxophleba</i>	<i>deirada</i> complex
<i>macrorhyncha</i>	<i>?particeps</i> <i>?conflecta</i>
?	<i>planitecta</i> <i>particeps</i>
<i>?major</i>	<i>brunneincincta</i>
<i>mannifera</i>	<i>amydra</i>
<i>marginata</i>	<i>icterica</i>
<i>Melaleuca acacioides</i>	<i>denigrata</i>
<i>Melaleuca argentea</i>	<i>melaleucae</i>
<i>Melaleuca cajuputi</i>	<i>devexa</i>
<i>Melaleuca leucadendron</i>	<i>melaleucae</i> <i>devexa</i>
<i>Melaleuca nervosa</i>	<i>melaleucae</i> <i>abudicola</i>
<i>Melaleuca quinquenervia</i>	<i>melaleucae</i> <i>paludis</i>
<i>Melaleuca viridiflora</i>	<i>devicola</i> <i>muminae</i>
<i>Euc. ?melanophloia</i>	<i>collina</i> <i>buxalis</i> <i>violae</i>
<i>meliiodora</i>	<i>neureta</i>
?	<i>prepta</i> <i>amydra</i> <i>locaridensis</i>
<i>microcarpa</i>	<i>quornensis</i>
?	<i>anomala</i> <i>fuscovena</i>
<i>microneura</i>	<i>froggatti</i>
<i>microtheca</i>	<i>froggatti</i> <i>anomala</i> <i>buxalis</i> <i>wakelburae</i> <i>retrusa</i>
?	<i>locaridensis</i> <i>suavis</i>
<i>miniata</i>	<i>anota</i>
<i>moluccana</i>	<i>egregia</i> <i>mannifera</i>
<i>niphophila</i>	<i>belua</i> <i>planitecta</i>
<i>?nitens</i>	<i>brimblecombei</i>
<i>normantonensis</i>	<i>froggatti</i>
<i>obliqua</i>	<i>planitecta</i> <i>particeps</i>
?	<i>eucalypti</i>
<i>oblonga</i>	<i>planitecta</i> <i>?particeps</i> <i>phreata</i>
?	<i>conflecta</i> <i>particeps</i>
<i>?occidentalis</i>	<i>deirada</i> complex (round lerps)
<i>odorata</i>	<i>schwarzi</i> <i>fuscovena</i>
<i>oleosa</i>	<i>repentina</i> <i>wanbiensis</i> <i>?occidentalis</i> <i>grapta</i>

Host	Species
?oleosa	wiradjurae notialis amnicola deirada complex
oligantha	froggatti
ovata	taylori lacustris
? "	eucalypti campbelli rivalis whitei
paniculata	kurrajongensis rivalis pilata permista mellialata
pauciflora	planitecta
? "	temenicola
phoenicea	anota
pileata-dumosa	pervagata notialis
pilularis	hirsuta seriata cyta
piperita	cyrtoma planaria salebrosa
platypus	deirada complex
polyanthemos	whitei amnicola
? "	mannifera
populnea	locaridensis suavis
? "	anomala
porosa	schwarzi notialis repentina
propinqua	imponens
? "	brunneincincta
punctata	australoraria ignea
radiata	dreptodria
" subplatyphylla	nundlensis
redunca	deirada complex ?occidentalis
resinifera	baileyi
" X robusta	oraria
robertsonii	planitecta endasa
robusta	baileyi siliciflava
? "	granulata
rodwayi	tagmata eucalypti nigrocincta
rossii	immaceria planitecta
rubida	minuscule
rudis	confinis
? "	deirada complex
saligna	baileyi granulata
salmonophloia	deirada complex (round lerps)
? "	pervagata grapta
salubris	deirada complex (round lerps)
seeana	xanthopepla
sideroxylon	sudicola
steberi	conserta
? "	obvelata
simmondsii	dreptodria munita temenicola planitecta
? "	occulta
stellulata	planitecta
? "	dreptodria
striatocalyx	pervagata froggatti
stricta	cyanoreia
tectifica	froggatti retrusa
tereticornis	brimblecombei pratensis struicis australoraria
? "	amnicola prepta
?tessellaris	brunneincincta
tetraptera	felicitaris
tetrodonta	lucrosa
? "	wagaitjae
thozetiana	anomala aurosala wakelburae
torquata	pervagata
Tristania conferta	australiensis
Euc. umbra	orientalis mactans inclusa
viminalis	eucalypti dobsoni
? "	minuscule
woollsiana	anomala fuscovena